Technology Benefit Estimator

(T/BEST)

USER'S MANUAL

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WELCOME TO T/BEST

This is the documentation on the T/BEST (Technology Benefit ESTimator) Users and Programmers Manual. T/BEST which is operational on IRIS SGI workstation is a computer software developed at NASA Lewis Research Center for the benefit analysis of aerospace propulsion systems.

In T/BEST, the following capabilities are integrated:

- engine cycle analysis, engine sizing and weight estimation
- fan, compressor, and turbine blade structural analyses
- transonic fluid flow solution and efficiencies for each rotor
- noise estimation
- range estimation
- aircraft weight analysis
- city pairs determination
- direct operating cost
- aircraft repair requirements cost
- engine maintenance cost
- mission performance

SUMMARY

The Technology Benefit Estimator (T/BEST) system is a formal method to assess advanced technologies and quantify the benefit contributions for prioritization. T/BEST may be used to provide guidelines to identify and prioritize high payoff research areas, help manage research and limited resources, show the link between advanced concepts and the bottom line, i.e., accrued benefit and value, and to credibly communicate the benefits of research.

The T/BEST software computer program is specifically designed for estimating benefits, and benefit sensitivities, of introducing new technologies into existing propulsion systems. Key engine cycle, structural, fluid, mission and cost analysis modules are used to provide a framework for interfacing with advanced technologies. An open-ended, modular approach is used to allow for modification and addition of both key and advanced technology modules. T/BEST has a hierarchical framework that yields varying levels of benefit estimation accuracy that are dependent on the degree of input detail available. This hierarchical feature permits rapid estimation of technology benefits even when the technology is at the conceptual stage. As knowledge of the technology details increases the accuracy of the benefit analysis increases.

Included in T/BEST's framework are correlations developed from a statistical data base that is relied upon if there is insufficient information given in a particular area, e.g., fuel capacity or aircraft landing weight. Statistical predictions are not required if these data are specified in the mission requirements. The engine cycle, structural, fluid, cost, noise, and emissions analyses interact with the default or user material and component libraries to yield estimates of specific global benefits: range, speed, thrust, capacity, component life, noise, emissions, specific fuel consumption, component and engine weights, pre-certification test, mission performance engine cost, direct operating cost, life cycle cost, manufacturing cost, development cost, risk, and development time.

Currently, T/BEST operates on stand-alone or networked workstations, and uses a UNIX shell or script to control the operation of interfaced FORTRAN based analyses. T/BEST's interface structure works equally well with non-FORTRAN or mixed software analyses. This interface structure is designed to maintain the integrity of the expert's analyses by interfacing with expert's existing input and output files. Parameter input and output data (e.g., number of blades, hub diameters, etc.) are passed via T/BEST's neutral file, while copious data (e.g., finite element models, profiles, etc.) are passed via file pointers that point to the experts' analyses output files. In order to make the communications between the T/BEST's neutral file and attached analyses codes simple, only two software commands, PUT and GET, are required. This simplicity permits easy access to all input and output variables contained within the neutral file. Both public domain and proprietary analyses codes may be attached with a minimal amount of effort, while maintaining full data and analysis integrity, and security.

T/BEST's software framework, status, beginner-to-expert operation, interface architecture, analysis module addition, key analysis modules are discussed. Representative examples of T/BEST benefit analyses are shown.

SECTION 1.0

INTRODUCTION

1.1 Learning About T/BEST

Improvements in technology have contributed to the advancement of research in the area of aerospace propulsion systems. To efficiently take advantage of these advances, the need arises to communicate the benefits of advanced technology in this research area. As a result, an effort was undertaken at NASA Lewis Research Center to develop a computational simulation, T/BEST (Technology Benefit ESTimator), that successfully integrates several disciplines in the area of aerospace propulsion systems to yield the benefits in emissions, noise, weights, thrust, range, specific fuel consumption, cost, etc.

T/BEST is an executive system developed for the benefit analysis of aerospace propulsion systems. Figure 1.1 depicts the default computational simulation modules of T/BEST. The executive system controls the execution of all modules as well as the flow of information between modules. A computational module is defined here as a FORTRAN (other languages may be included) program with a specified analysis capability. All modules inter-communicate via a data bank system named *neutral.file*.

The first and last analysis modules executed in T/BEST are, respectively, NNEPWATE [Ref. 1] and FLOPS [Ref. 11]. Each module requires prior to execution the availability of its standard input file(s). These files are generated using built-in pre-processor in T/BEST with the exception of NNEPWATE where these files are to be provided by the user. NNEPWATE sample input files will be available in the first release of T/BEST.

The disciplines integrated in T/BEST are:

1. thermodynamics
2. structures
3. fluid flow
4. cost
5. mission
6. emissions
7. noise

The T/BEST executive system conforms with three levels of user's expertise:

1. beginner, a first time user, is advised to execute T/BEST using the sample example included in the first release (section 3.2).

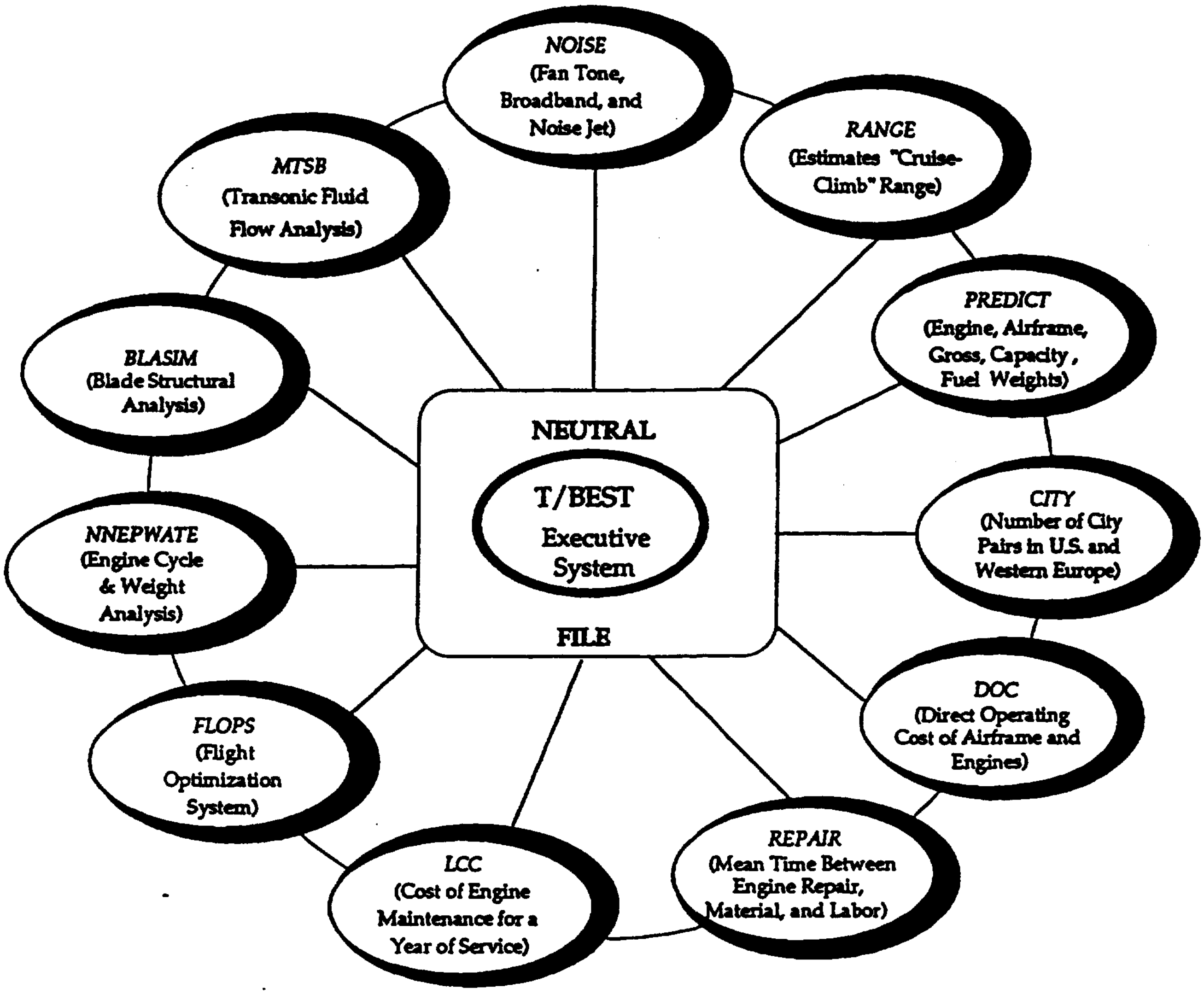

Figure 1.1 Default Computational Simulation Modules
of the T/BEST Executive System

2. intermediate, a user that has executed T/BEST several times, must be able to modify many neutral file default parameters (section 3.3).
3. expert, a user with extensive experience in executing T/BEST, must be able to modify all neutral file default parameters. Also, an expert can add or remove modules to or from T/BEST.

1.2 How to Use This Manual

The primary objective of this User's Manual is to provide information and practices for learning the T/BEST system. This manual is divided into seven sections and four appendices.

The introduction is found in the first section followed by setting-up T/BEST in section 2. One example is included in this manual in section 3 while section 4 provides a complete description of the T/BEST executive system. The T/BEST analyses modules are discussed in section 5 followed by parametric studies in section 6. The references for all modules in T/BEST are listed in section 7.

Appendix A describes the example for a supersonic mission in addition to complete listing of the NNEPWATE engine input and map files, and the T/BEST neutral file. The content and format of the airfoil data bank used to generate the geometry of the fan, compressor, and turbine blades is discussed in appendix B. The blade geometry is used by both BLASIM [Ref. 3] and MTSB [Ref. 4] modules.

Appendix C lists the neutral file input parameters given to and/or obtained form a module. A complete listing of the UNIX shell script used to execute T/BEST is available in appendix D as well as listing of the names of executables of all modules in T/BEST . Also, appendix D contains a listing of the material data bank that is needed to provide the BLASIM module with material properties to conduct structural analysis of fan, compressor and turbine blades.

SECTION 2.0

SETTING UP T/BEST

2.1 Preparing to Use T/BEST

The effort required to prepare to use T/BEST is discussed here. Before executing T/BEST, the user must prepare the two input files required to run the NNEPWATE [Ref. 1] module. The first file which must have the extension "*.input*" contains information pertaining to components types and their configurations to form a specific engine. The second file with the extension "*.maps*" contains all performance map tables used to model off design performance of engine components. The NNEPWATE input files must be placed in the user's T/BEST input sub-directory. Typical input and map files are listed in appendix A.

The T/BEST directory tree, described in details in the following section, is shown in Figure 2.1.

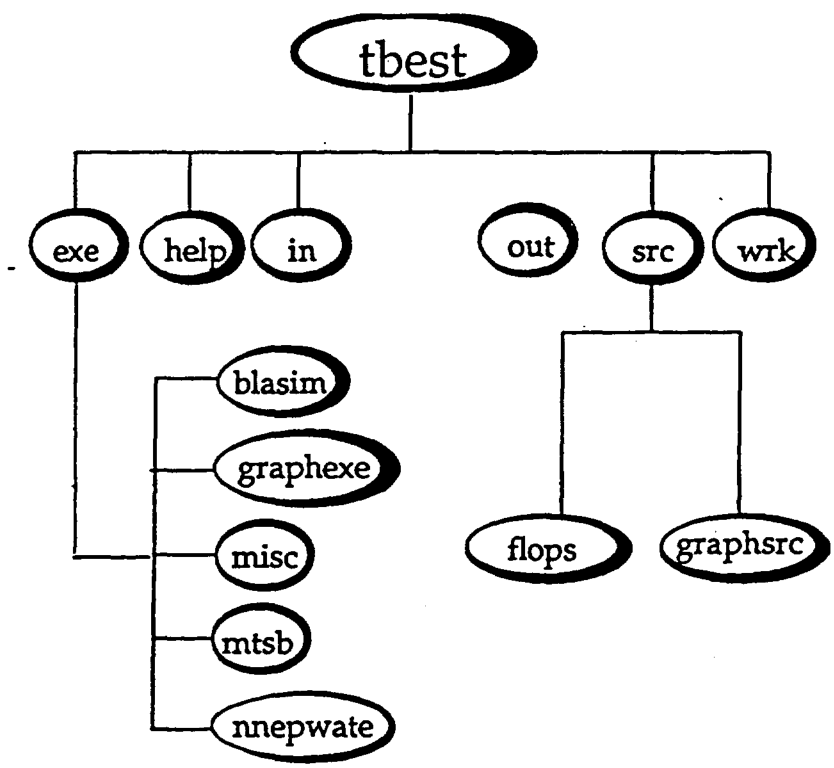

Figure 2.1 T/BEST Directory Tree

2.2 Restoring T/BEST *tar file* and Directories

The installation of T/BEST on a workstation is made easy by utilizing the UNIX *tar* command which saves and restores files on a magnetic tape. All the T/BEST system is stored in a single file named *tbest.tar* . A single command is required to load *tbest.tar* off a tape and restore all the T/BEST files: *tar xvf /dev/tape tbest.tar* .

The T/BEST system is structured to provide the user with excellent book-keeping facilities. Input and output files, source codes, and executables of all modules are stored in pre-assigned sub-directories. The mother directory is named *tbest* and at that level the execution of T/BEST is activated. The shell script that controls the execution of T/BEST is located here under the name *tbest.exe*. The sub-directories that are branched out of *tbest* are listed below:

/tbest/exe

Several sub-directories containing executable for various modules ramify from here:

/tbest/exe/blasim

Contains executable of the BLASIM module: *blasim.exe.*

/tbest/exe/mtsb

Contains executable of the MTSB module: *mtsb.exe.*

/tbest/exe/misc

Contains the following executables: *blasimgen.exe, blasimpost.exe, blasimsr.exe, mtsbgen.exe, mtsbpost.exe, noise.exe, range.exe, predict.exe, city.exe, doc.exe, repair.exe, lcc.exe , flopsgen.exe,* and *flopspost.exe.*

/tbest/exe/nnepwate

Contains executable of the NNEPWATE module: *nnepwate.exe.*

/tbest/exe/flops

Contains executable of the FLOPS module: *flops.exe.*

/tbest/exe/graphexe

Contains executable of the graphic modules: *pchart.exe and bchart.exe* for pie chart and bar chart display of results.

/tbest/ help

The T/BEST help utility is found here. It is a UNIX file named *help_tbest.* This capability can be executed to provide general help information while running the T/BEST executive system.

/tbest/in

All input files generated during the execution of T/BEST are stored here. This includes input files for BLASIM, MTSB, NNEPWATE, and FLOPS modules as well as the neutral file which is updated following the execution of each module.

/tbest/out

Output files for BLASIM, MTSB, NNEPWATE, and FLOPS modules are stored here.

/tbest/src

Contains source codes for all analyses modules and their pre-and-post processors. The analyses modules residing here are: NNEPWATE, BLASIM, MTSB, NOISE, RANGE, PREDICT, CITY, DOC, REPAIR, and LCC. The pre-and-post-processors modules are: BLASIMGEN, BLASIMPOST, BLASIMSR, MTSBGEN, MTSBPOST, FLOPSGEN, and FLOPSPOST. Complete description of all analyses modules is given in section 5.

A sub-directory is branched out at this level:

/tbest/src/flops

Contains FLOPS FORTRAN source code. The FLOPS module consists of the following programs: sfareo.f, sfcost.f, sfcycl.f, sfeng.f, sffoot.f, sfmain.f, sfperf.in, sftol.f, sfwate.f, smacyc.f, and smatol.f.

Another sub-directory is branched out at this level:

/tbest/src/graphsrc

Contains FORTRAN and C source codes for bar and pie charts graphic modules: BCHART, BARCHART, PCHART, and PIECHART. These modules display graphically cost and repair results obtained from the T/BEST neutral file. Refer to section 4 for further details.

/tbest/wrk

This is the working sub-directory of the T/BEST executive system. All scratch and non essential files are stored here. These files could be accessed by the user for further processing.

When the execution of T/BEST is completed, the NNEPWATE, BLASIM, MTSB and FLOPS input and output files are stored in */user/tbest/out* and */user/tbest/in* sub-directories. The updated neutral file is stored in */user/tbest/in* sub-directory. The example given in section 3 will walk the user through the steps of setting-up and executing T/BEST.

SECTION 3.0

DEMONSTRATION OF T/BEST

3.1 Executing T/BEST

Once the T/BEST tar file has been loaded on an SGI workstation and all sub-directories have been restored as indicated in Section 2 , a first-time user of the system is advised to execute T/BEST using one of the already existing examples. A simple command is required to start the execution of T/BEST:

/usr/userid/tbest: tbest.exe

The tbest.exe file is a UNIX shell script which controls the execution of T/BEST. Refer to section 4 for a complete description of the T/BEST executive system. Prior to running T/BEST, the engine input and map files used by the NNEPWATE module for engine cycle analysis and weight approximation must be placed in the T/BEST input sub-directory. An array of engine examples, supersonic and subsonic missions, already have been embedded into the input sub-directory to facilitate the use T/BEST, especially for first-time users.

In this section, T/BEST is executed for a sample example pertaining to a supersonic engine operating under constant design thrust. A complete description of the example is available in section A.1 of appendix A. The steps required to construct the fan, compressor and turbine blades are discussed in section A.2. Listings of the engine input and map files are available in sections A.3 and A.4. The neutral file obtained at the end of the execution of T/BEST is listed in its entirety in section A.5.

In this example, a special feature of BLASIM, ice impact on fan blades, is demonstrated. It is assumed that a piece of ice having a radius of 0.8" and traveling at a speed of 150 knots impacts the first stage fan blade. The foreign object damage analysis capability is carried out at any stage once VELFOD is larger than zero. The input parameters are listed below:

1. VELFOD (foreign object velocity, knots)
2. DENFOD (foreign object density, lb.sec^2/in^4)
3. RADFOD (foreign object spherical radius, in.)

Many parameters used in the neutral file are initially defined by default. For example, some of these parameters are aircraft gross weight, fuel and engine oil cost, etc.. Section 4.2 discusses in details the content and structure of the neutral file. Appendix C lists the neutral file parameters going into a module and coming out of a module.

3.2 Interactive Session for the Supersonic Engine Example

The interactive sessions seen on a computer screen while running T/BEST using the supersonic engine are shown in this section. The execution of T/BEST is automatic and requires very minimum user's interaction. Note that each screen is separated by two lines. Each input or response to questions shown is highlighted in bold letters. Description and listing of input and output of this example is found in appendix A.

```
TTTTTTTTTTTT       //  BBBBBBBBBBB   EEEEEEEEEEEE   SSSSSSSSSS   TTTTTTTTTTTT
TTTTTTTTTTTT      //   BBBBBBBBBBBB  EEEEEEEEEEEE  SSSSSSSSSSSS  TTTTTTTTTTTT
     TT           //   BB        BB  EE            SS        SS       TT
     TT          //    BB        BB  EE            SS                 TT
     TT          //    BB       BB   EE            SSS                TT
     TT         //     BBBBBBBBBB    EEEEEEEE       SSSSSSSSS         TT
     TT         //     BBBBBBBBBB    EEEEEEEE         SSSSSSSSS       TT
     TT        //      BB       BB   EE                      SSS      TT
     TT        //      BB        BB  EE                       SS      TT
     TT       //       BB        BB  EE            SS         SS      TT
     TT       //       BBBBBBBBBBBB  EEEEEEEEEEEE  SSSSSSSSSSSS       TT
     TT      //        BBBBBBBBBBB   EEEEEEEEEEEE   SSSSSSSSSS        TT

                        Technology Benefit ESTimator

 user's id                                                    DATE xxxx
 user's name                                                  TIME xxxx

Press <return> to continue . . . or press h for help . . . <CR>
```

```
                 Executing neutgen
     Generating neutral file for T/BEST

     INPUT: neutral.file default parameters
     OUTPUT:/usr/lerc/smabmri/tbest/in/neutral.file

     Press <return> to continue . . . <CR>
```

```
                 ***** WELCOME TO T/BEST *****

                 *****************************

      The T/BEST executive system utilizes a data bank named
      neutral.file to exchange information among all modules.
      Prior to the execution of T/BEST, you may update or modify
      any of the defaulted parameters in neutral.file. For a
      complete description of neutral.file, please refer to the
      T/BEST User's Manual.

      Do you wish to update any of the defaulted parameters?
             (Enter Yes or No):y

      In T/BEST, the user's level of expertise is classified as:


                           1) BEGINNER
                           2) INTERMEDIATE
                           3) EXPERT

      Select your level of expertise by entering
```

```
the corresponding level number: 3
```

```
For an expert user, any parameter in the neutral.file
may be updated. At this level of expertise, the list of
parameters will not be displayed on screen. For information
on the content and structure of the neutral.file, please
refer to the T/BEST User's Manual.

       Hit Return to Continue ....<CR>
```

```
Enter the parameter keyword as listed in the T/BEST
neutral.file: VELFOD

Please indicate whether the selected keyword belongs to
a specific engine component data set.
       (Enter Yes or No):y

Please indicate whether the selected keyword belongs to
a specific stage of an engine component data set.
       (Enter Yes or No):y

Please enter the engine component number: 2

Please enter the stage number: 1

Enter the new value of VELFOD  : 150.0

Do you wish to update more parameters?
       (Enter Yes or No): y
```

```
Enter the parameter keyword as listed in the T/BEST
neutral.file: DENFOD

Please indicate whether the selected keyword belongs to
a specific engine component data set.
       (Enter Yes or No):y

Please indicate whether the selected keyword belongs to
a specific stage of an engine component data set.
       (Enter Yes or No):y

Please enter the engine component number: 2

Please enter the stage number: 1

Enter the new value of DENFOD  : 0.9E-04

Do you wish to update more parameters?
       (Enter Yes or No): y
```

```
Enter the parameter keyword as listed in the T/BEST
neutral.file: RADFOD

Please indicate whether the selected keyword belongs to
a specific engine component data set.
       (Enter Yes or No):y

Please indicate whether the selected keyword belongs to
a specific stage of an engine component data set.
       (Enter Yes or No):y

Please enter the engine component number: 2
```

```
Please enter the stage number: 1

Enter the new value of RADFOD  : 0.80

Do you wish to update more parameters?
       (Enter Yes or No): n
```

```
              T/BEST has chosen supersonic as its input
Would you like to use a different input file ? (Y/N) n
```

```
              Executing nnepwate
Engine cycle and weight analyses

INPUT: /usr/lerc/smabmri/tbest/in/hsr_cdt.input
OUTPUT: /usr/lerc/smabmri/tbest/out/hsr_cdt.output
```

```
              Executing nneppost
Post-Processing nnepwate output

INPUT: /usr/lerc/smabmri/tbest/out/hsr_cdt.output
OUTPUT:/usr/lerc/smabmri/tbest/in/neutral.file

Press <return> to continue . . . <CR>
```

```
              Executing blasimgen
Generating blasim input files for all stages
of each fan, compressor, and turbine

INPUT:  neutral.file
OUTPUT: blasim input files

Press <return> to continue . . .<CR>
```

```
       BLASIM is processing BFAN0201.INP
Blade structural analysis

INPUT: /usr/lerc/smabmri/tbest/in/BFAN0201.INP
OUTPUT: /usr/lerc/smabmri/tbest/out/BFAN0201.OUT
```

```
       BLASIM is processing BFAN0202.INP
Blade structural analysis

INPUT: /usr/lerc/smabmri/tbest/in/BFAN0202.INP
OUTPUT: /usr/lerc/smabmri/tbest/out/BFAN0202.OUT
```

```
       BLASIM is processing BHPC0501.INP
Blade structural analysis

INPUT: /usr/lerc/smabmri/tbest/in/BHPC0501.INP
OUTPUT: /usr/lerc/smabmri/tbest/out/BHPC0501.OUT
```

```
       BLASIM is processing BHPC0502.INP
Blade structural analysis

INPUT: /usr/lerc/smabmri/tbest/in/BHPC0502.INP
OUTPUT: /usr/lerc/smabmri/tbest/out/BHPC0502.OUT
```

```
       BLASIM is processing BHPC0503.INP
Blade structural analysis

INPUT: /usr/lerc/smabmri/tbest/in/BHPC0503.INP
```

```
OUTPUT: /usr/lerc/smabmri/tbest/out/BHPC0503.OUT
```

```
        BLASIM is processing BHPC0504.INP
Blade structural analysis

INPUT: /usr/lerc/smabmri/tbest/in/BHPC0504.INP
OUTPUT: /usr/lerc/smabmri/tbest/out/BHPC0504.OUT
```

```
        BLASIM is processing BHPC0505.INP
Blade structural analysis

INPUT: /usr/lerc/smabmri/tbest/in/BHPC0505.INP
OUTPUT: /usr/lerc/smabmri/tbest/out/BHPC0505.OUT
```

```
        BLASIM is processing BHPT0801.INP
Blade structural analysis

INPUT: /usr/lerc/smabmri/tbest/in/BHPT0801.INP
OUTPUT: /usr/lerc/smabmri/tbest/out/BHPT0801.OUT
```

```
        BLASIM is processing BLPT0901.INP
Blade structural analysis

INPUT: /usr/lerc/smabmri/tbest/in/BLPT0901.INP
OUTPUT: /usr/lerc/smabmri/tbest/out/BLPT0901.OUT
```

```
        BLASIM is processing BLPT0902.INP
Blade structural analysis

INPUT: /usr/lerc/smabmri/tbest/in/BLPT0902.INP
OUTPUT: /usr/lerc/smabmri/tbest/out/BLPT0902.OUT
```

```
              Executing blasimpost
Update neutral file to include structural response parameters

INPUT:  blasim output files
OUTPUT: neutral.file

Press <return> to continue . . .<CR>
```

```
              Executing mtsbgen
Generating mtsb input files for all stages
of each fan, compressor, and turbine

INPUT:  neutral.file
OUTPUT: mtsb input files

Press <return> to continue . . .<CR>
```

```
MTSB is processing MFAN0201.INP
Transonic flow analysis

INPUT: /usr/lerc/smabmri/tbest/in/MFAN0201.INP
OUTPUT: /usr/lerc/smabmri/tbest/out/MFAN0201.OUT
```

```
MTSB is processing MFAN0202.INP
Transonic flow analysis

INPUT: /usr/lerc/smabmri/tbest/in/MFAN0202.INP
OUTPUT: /usr/lerc/smabmri/tbest/out/MFAN0202.OUT
```

```
MTSB is processing MHPC0501.INP
Transonic flow analysis

INPUT: /usr/lerc/smabmri/tbest/in/MHPC0501.INP
OUTPUT: /usr/lerc/smabmri/tbest/out/MHPC0501.OUT
```

```
MTSB is processing MHPC0502.INP
Transonic flow analysis

INPUT: /usr/lerc/smabmri/tbest/in/MHPC0502.INP
OUTPUT: /usr/lerc/smabmri/tbest/out/MHPC0502.OUT
```

```
MTSB is processing MHPC0503.INP
Transonic flow analysis

INPUT: /usr/lerc/smabmri/tbest/in/MHPC0503.INP
OUTPUT: /usr/lerc/smabmri/tbest/out/MHPC0503.OUT
```

```
MTSB is processing MHPC0504.INP
Transonic flow analysis

INPUT: /usr/lerc/smabmri/tbest/in/MHPC0504.INP
OUTPUT: /usr/lerc/smabmri/tbest/out/MHPC0504.OUT
```

```
MTSB is processing MHPC0505.INP
Transonic flow analysis

INPUT: /usr/lerc/smabmri/tbest/in/MHPC0505.INP
OUTPUT: /usr/lerc/smabmri/tbest/out/MHPC0505.OUT
```

```
MTSB is processing MHPT0801.INP
Transonic flow analysis

INPUT: /usr/lerc/smabmri/tbest/in/MHPT0801.INP
OUTPUT: /usr/lerc/smabmri/tbest/out/MHPT0801.OUT
```

```
MTSB is processing MLPT0901.INP
Transonic flow analysis

INPUT: /usr/lerc/smabmri/tbest/in/MLPT0901.INP
OUTPUT: /usr/lerc/smabmri/tbest/out/MLPT0901.OUT
```

```
MTSB is processing MLPT0902.INP
Transonic flow analysis

INPUT: /usr/lerc/smabmri/tbest/in/MLPT0902.INP
OUTPUT: /usr/lerc/smabmri/tbest/out/MLPT0902.OUT
```

```
                 Executing mtsbpost
Update neutral file to include output parameters form mtsb

INPUT:  mtsb output files
OUTPUT: neutral.file

Press <return> to continue . . . <CR>
```

```
                 Executing noise
Estimates fan tone, broadband and noise jet
Update neutral file
```

INPUT: **neutral.file**
OUTPUT: **updated neutral.file**

Press <return> to continue . . . *<CR>*

Executing range
Estimates the BREGUET cruise-climb range
Update neutral file

INPUT: **neutral.file**
OUTPUT: **updated neutral.file**

Press <return> to continue . . . *<CR>*

Executing **city**
Determines number of city pairs in U.S. and Western Europe
Update neutral file

INPUT: **neutral.file**
OUTPUT: **updated neutral.file**

Press <return> to continue . . .*<CR>*

Executing **repair**
Estimates mean time between engine repair and material/labor
Update neutral file

INPUT: **neutral.file**
OUTPUT: **updated neutral.file**

Press <return> to continue . . .*<CR>*

Executing **doc**
Predicts direct operating cost of airframe and engines
Update neutral file

INPUT: **neutral.file**
OUTPUT: **updated neutral.file**

Press <return> to continue . . .*<CR>*

Executing lcc
Predicts engine maintenance cost for a given year of service
Update neutral file

INPUT: **neutral.file**
OUTPUT: **updated neutral.file**

Press <return> to continue . . .*<CR>*

Executing **flopsgen**
Generating flops input file

INPUT: **neutral.file**
OUTPUT: **flopsin.file**

Press <return> to continue . . . *<CR>*

Executing **flops**
Flight Optimization System (mission/cost analyses)

```
        INPUT:  flopsin.file
                file renamed supersonic.flopsin
        OUTPUT: flopsout.file
                file renamed supersonic.flopsout

EXECUTING FLOPS RELEASE 5.4

        Press <return> to continue . . .<CR>
```

```
                    Executing flopspost
        Updating neutral file to include flops response parameters

        INPUT:  flopsout.file
        OUTPUT: neutral.file

        Press <return> to continue . . .<CR>
```

```
        T/BEST neutral.file renamed supersonic.neutral
        User'sneutral file is located in
        /usr/lerc/smabmri/tbest/in sub-directory

        Press <return> to continue . . . <CR>
```

```
        Execution of graphic codes to display results

        Press <return> to continue . . .
```

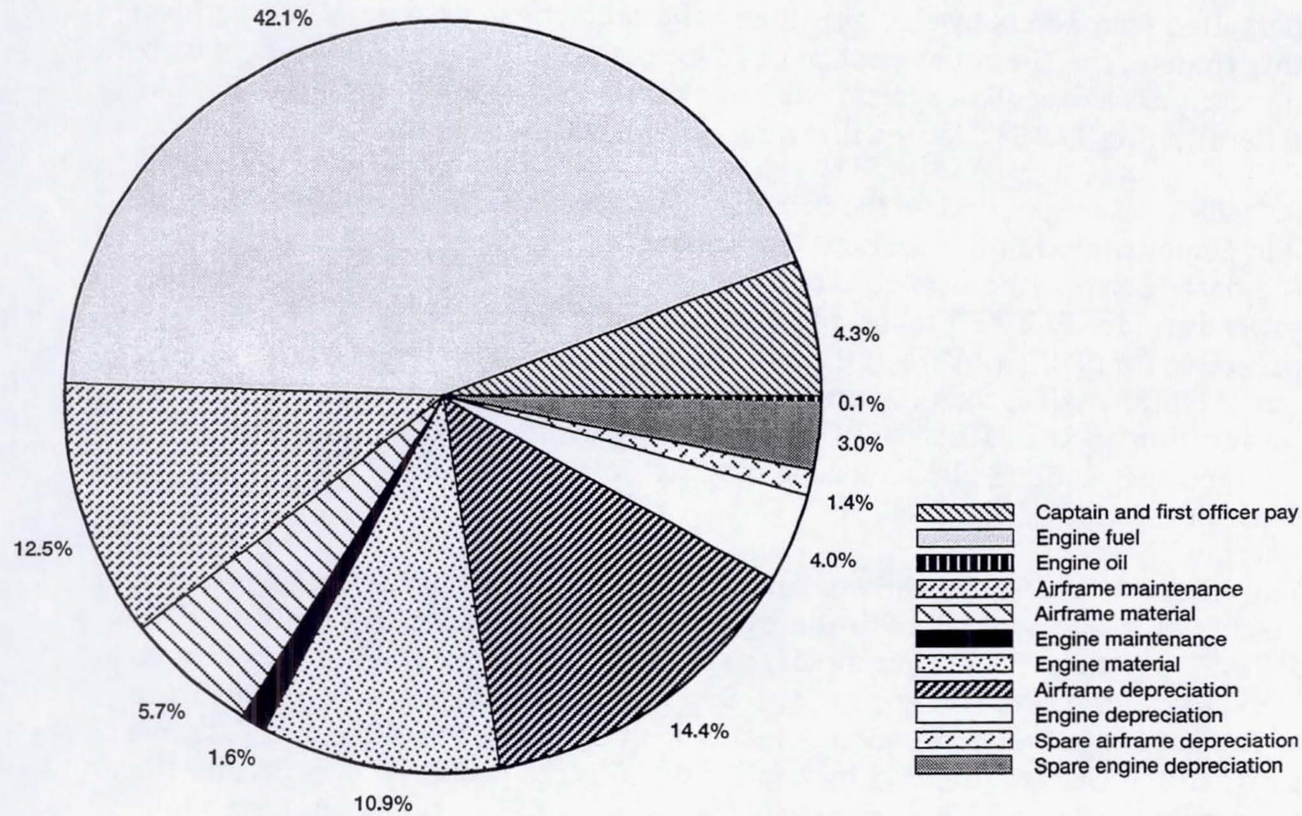

Figure 3.1.—Engine direct operating cost pie chart.

3.3 Changing Neutral File Default Parameters

In T/BEST, a user's level of expertise can be classified as beginner, intermediate or expert. A beginner user may modify the values of few parameters while an expert may modify the value of any parameter in the neutral file. More parameters may be changed by an intermediate user than with a beginner.

The neutral file default parameters are stored in *neutral.add* file. A complete listing of this file is given in section C.1 of appendix C. The user can update defaulted parameters by changing their values directly in *neutral.add*. To perform this change, the file must exist prior to executing T/BEST in */usr/tbest/in* subdirectory. The executive system will not overwrite a pre-existing *neutral.add* file. After running T/BEST for the first time, neutral.add is generated automatically.

A T/BEST user may update the defaulted parameters while executing T/BEST as it is demonstrated in this section. The interactive technique of updating neutral file data permits the user to modify the value of any parameter. The update procedure in T/BEST takes place while executing NNEPPOST, the post-processor for NNEPWATE. If the user decided to overwrite a parameter coming out of NNEPWATE, than the user must know the stage and component numbers in addition to the KEYWORD associated with the selected parameter. The interactive technique allows for the modification of *neutral.add* data as well as those post-processed by NNEPPOST.

The interactive session shown here are that of the same example problem discussed in section 3.2 with the exception that the capability embedded in T/BEST that allows a user to modify neutral file default parameters is exercised. Here, the expert user changes the airfoil type and material property for the blade of the fan (stage 1 of component 2). Also, the default values of the fuel cost and jet oil in the US. are updated by a factor of 2.0. Note that only a portion of the interactive session which demonstrate the update capability is shown here.

```
                    ***** WELCOME TO T/BEST *****

                    *****************************

    The T/BEST executive system utilizes a data bank named
    neutral.file to exchange information among all modules.
    Prior to the execution of T/BEST, you may update or modify
    any of the defaulted parameters in neutral.file. For a
    complete description of neutral.file, please refer to the
    T/BEST User's Manual.

    Do you wish to update any of the defaulted parameters?

       (Enter Yes or No):y
```

```
    In T/BEST, the user's level of expertise is classified as:
```

```
                    1) BEGINNER
                    2) INTERMEDIATE
                    3) EXPERT

Select your level of expertise by entering
the corresponding level number: 3
```

```
For an expert user, any parameter in the neutral.file
may be updated. At this level of expertise, the list of
parameters will not be displayed on screen. For information
on the content and structure of the neutral.file, please
refer to the T/BEST User's Manual.

       Hit Return to Continue ....
```

```
Enter the parameter keyword as listed in the T/BEST
neutral.file: AIRCODE
```

(for changing airfoil profile)

```
Please indicate whether the selected keyword belongs to
a specific engine component data set.
       (Enter Yes or No):y
```

```
Please indicate whether the selected keyword belongs to
a specific stage of an engine component data set.
       (Enter Yes or No):y
```

```
Please enter the engine component number: 2

Please enter the stage number: 1
```

```
Please select airfoil type form table below:
       1) NACA 63A210 FAN
       2) NACA 63A210 TUR
       3) NACA 64-206 FAN
       4) NACA 64-206 TUR
       5) NACA 66-206 FAN
       6) NACA 66-206 TUR

                Enter airfoil type number:1
```

```
Do you wish to update more parameters?
       (Enter Yes or No):y

Enter the parameter keyword as listed in the T/BEST
neutral.file: MATSLC
```

(for changing blade material)

```
Please indicate whether the selected keyword belongs to
a specific engine component data set.
       (Enter Yes or No):y
```

```
Please indicate whether the selected keyword belongs to
a specific stage of an engine component data set.
       (Enter Yes or No): y
```

```
Please enter the engine component number: 2
```

```
Please enter the stage number:1

Please select blade material from the table below:
       1) ALUMINUM
       2) BERYLLIUM
       3) FECR SUPER ALLOY
       4) STAINLESS STEEL
       5) TITANIUM

Enter material number: 4
```

```
Do you wish to update more parameters?
       (Enter Yes or No):y
```

```
Enter the parameter keyword as listed in the T/BEST
neutral.file: AFUELD
```

(for changing domestic fuel cost)

```
Please indicate whether the selected keyword belongs to
a specific engine component data set.
       (Enter Yes or No):n
```

```
Please indicate whether the selected keyword belongs to
a specific altitude data set.
       (Enter Yes or No):n
```

```
Enter the new value of AFUELD  : 0.22
```

```
Do you wish to update more parameters?
       (Enter Yes or No):y
```

```
Enter the parameter keyword as listed in the T/BEST
neutral.file: BOILTD
```

(for changing engine oil cost)

```
Please indicate whether the selected keyword belongs to
a specific engine component data set.
       (Enter Yes or No):n
```

```
Please indicate whether the selected keyword belongs to
a specific altitude data set.
       (Enter Yes or No):n
```

```
Enter the new value of BOILTD  : 12.0
```

```
Do you wish to update more parameters?
       (Enter Yesor No):n
```

```
T/BEST has chosen supersonic as its input
Would you like to use a different input file? (Y/N) n
```

SECTION 4.0

DESCRIPTION OF T/BEST EXECUTIVE SYSTEM

In this section, an overview of the T/BEST executive system and its capabilities as a computer software are presented.

4.1 T/BEST Modules Interaction

Twenty-one modules make up the T/BEST executive system. Inter-modular chart of T/BEST is shown in Figure 4.1. All modules in T/BEST are written in FORTRAN with the exception of the graphic modules BCHART and PCHART which are made of FORTRAN and C programs. The order of execution of these modules is clockwise beginning with NEUTGEN and ending with BCHART

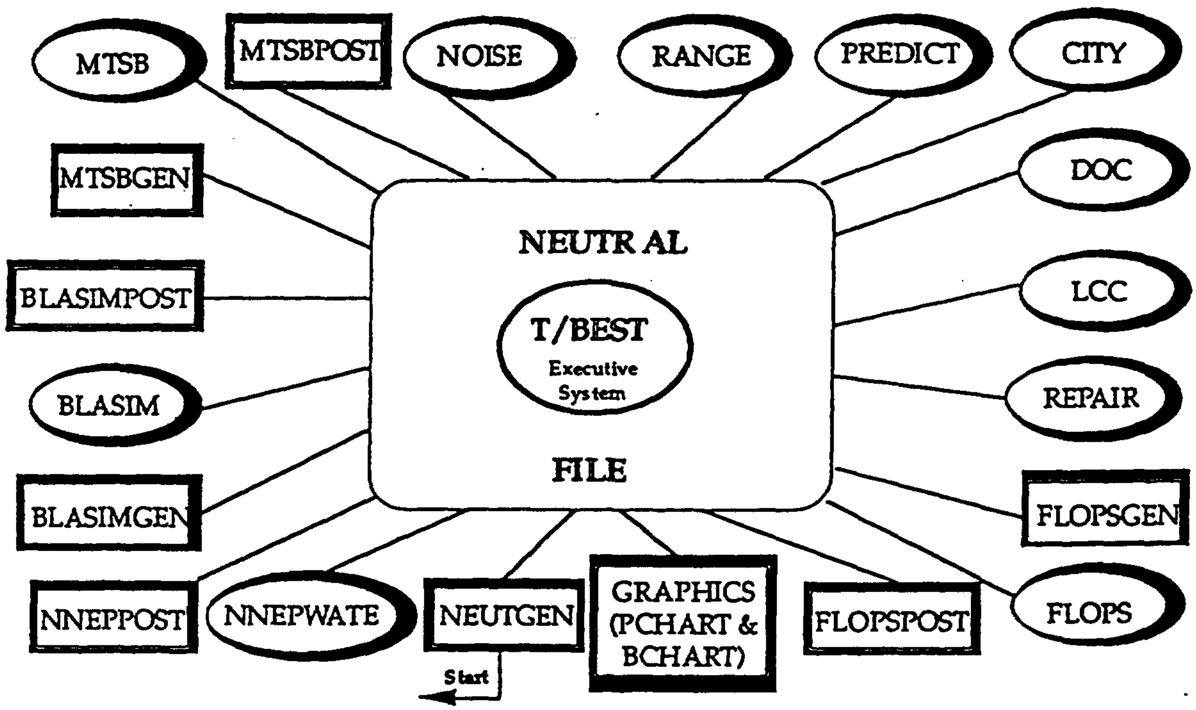

Figure 4.1 Inter-Modular Chart for the T/BEST Executive System

The execution of PREDICT is conditional to the following:

1. GW (aircraft gross weight) equals to zero
2. AW (airframe weight) equals to zero
3. FW (fuel weight) and FCR (fuel consumed at cruise) equal to zero

The RANGE module is executed if the RANGE parameter is zero in the neutral file. Note that the execution of the remaining modules is definite.
In this section, the interaction mode among all T/BEST modules is summarized. The information provided here guide an expert user to add, remove, or modify a T/BEST module if necessary. At the developmental stage of T/BEST, portability and modularity were determined to be a requirement.

NEUTGEN: This FORTRAN module is the first to be executed in T/BEST. It generates a file in /user/tbest/in sub-directory named*neutral.add* which is used to define the default values, for example, maintenance, repair and cost parameters. Also, at this stage a user has the opportunity to modify any parameter that is defaulted in the neutral file. Section C.1 of appendix C shows in details the data obtained and/or generated by this module and stored in the neutral file.

In T/BEST, the level of expertise of a user is classified as beginner, intermediate or expert. A beginner user can modify few selected defaulted parameters while an expert user may change the value of any defaulted parameter. An intermediate user may change more parameters than the one allowed for a beginner but less than that of an expert. All that is required is a knowledge of the parameter keyword. If any defaulted parameters are to be changed, NEUTGEN writes these data in a special file named *neutral.modify* located in the tbest input sub-directory. The procedure of changing the values of defaulted parameters has been demonstrated in the previous section.

NNEPWATE: This module is a combination of two FORTRAN computer codes: NNEP89 and WATE89. Two input files, file.*input* and file.*maps* are required to run the NNEPWATE module. It is required to place these files in the T/BEST input sub-directory. If more than one set of input and map files exist, the user must choose a specific set. The NNEPWATE output file stored in the T/BEST output sub-directory is used to provide the neutral file with information on the engine configuration. Section C.2 of appendix C shows in details the neutral file data obtained and/or generated by this module.

NNEPPOST: This FORTRAN module is used to post-process data from the NNEPWATE output file. Engine component and stage data are read from this file. When this module is executed, the neutral file is fully generated with assigned parameters describing engine configuration in addition to the defaulted data. Section C.3 of appendix C shows in details the neutral file data obtained and/or generated by this module.

The NNEPPOST module generates a mission data file,*nnepwate.missout,* named after the defaulted neutral file keyword EIFILE. This file contains thrust, fuel flow, and specific fuel consumption at various Mach number and altitude sets (off-design points). These data are required to run the FLOPS (FLight OPtimization System) module.

BLASIMGEN: This FORTRAN module generates the input file for BLASIM (blade structural analyzer). The input file naming procedure follows a specific criterion: B*typiijj*.INP where

- *typ* is the component type such as FAN, HPT (high pressure turbine), LPT (low pressure turbine), HPC (high pressure compressor), and LPC (low pressure compressor).
- *ii* is the component number, for example component number 1 is represented by 01.
- *jj* is the stage number.

Section C.4 of appendix C shows in details the neutral file data obtained and/or generated by this module. The BLASIM input file is only generated for components that carry rotating stages (FAN, HPT, LPT, HPC, and LPC).

The blade for a rotating stage is defined using one of the two methods listed below:

AIRFOIL DEFINITION described via the neutral file keyword AIRCODE. By default, the blade profile is based on the airfoil type NACA 64-206 FAN for fan and compressors and NACA 64-206 TURBINE for turbines (see airfoil data bank in appendix B). The blade is constructed based on the following considerations:

- number of stations: 11
- number of coordinates per station (it is the same for all stations): 11
- one stagger angle used for all stations: 35 Degrees
- root thickness is defined as a percentage of the first chord: 6%
- chord length for the all stations is interpolated from the mean chord length. Note that the blade taper ratio, hub and tip radii are obtained from the NNEPWATE output.
- an expert user can modify all the above and vary the stagger angle for each station.

FULL BLADE DEFINITION described via the neutral file keyword ABLDEF. The airfoil data bank (appendix B) is capable of accepting full blade geometry in addition to the airfoil definition. The user must construct the blade based on parameters obtained from NNEPWATE. These parameters are: aspect ratio, and hub and tip radii. This input option requires a detailed airfoil at each station which includes: upper and lower coordinates, spanwise coordinates, blade radius, and stagger angle.

Appendix B describes in details along with several examples the format and data required to define an airfoil to construct a blade or to input a full blade geometry. Note that both airfoil and blade definitions use standard industry format.

BLASIM: This FORTRAN module is used for the structural analysis of the blade including foreign object damage (e.g. ice impact). BLASIM performs static, modal, fatigue, resonance margin, and flutter analyses of engine blades. Although it is capable of handling composite blades, for simplicity, the blade consists of a single material. The BLASIM module is executed automatically for those stages which input have been generated. Its input is read on logical unit 25. The defaulted analyses options performed by BLASIM for each stage are: static, modal, fatigue, and resonance margin. Foreign object damage (FOD) assessment is evaluated once the velocity (VELFOD), radius (RADFOD) and density (DENFOD), respectively, are updated to values other than zero. Note that BLASIM does not supply directly any data to the neutral file (section C.5).

Two input files are required to run BLASIM: the main input file contain analysis options and blade geometry, and a material data bank file listed in section D.4 of appendix D. The BLASIM input files are stored in the */user/tbest/in* sub-directory while the output files are stored in */user/tbest/out* sub-directory. The material and airfoil data banks, *databk.data* and *airfoil.bank,* must be stored in the */user/tbest* mother directory.

Each time BLASIM is executed an independent routine named BLASIMSR is run to process static stresses from BLASIM and compute the failure root stress function based on the modified distortion energy (MDE) criterion [Ref. 10]. This is the only routine in T/BEST with a minor function and not shown on the modular chart. BLASIMSR temporary places the MDE function in a file named *static.root* which will be read by BLASIMPOST and stored in the neutral file.

BLASIMPOST: This FORTRAN module is used to post-process the BLASIM output file, *Btypiijj*.OUT, for each rotating stage. The *Btypiijj*.OUT file supplies the neutral file with the required data as shown in section C.6 of appendix C.

MTSBGEN: This FORTRAN module generates the input file to the quasi-3D fluid analysis module MTSB. The MTSB input file naming procedure is similar to the one used for the BLASIM input with one difference being in the first letter: *Mtypiijj*.INP. Unless otherwise specified, the blade model is generated based on the neutral file defaulted airfoil NACA 64-206 . The airfoil data bank, *airfoil.bank,* discussed in appendix B is used to input airfoil or full blade definition. The procedure applied to generate the blade for BLASIM is used here. The MTSB input file is generated for all rotating stages. Section C.7 of appendix C shows in details the neutral file data obtained and/or generated by this module.

MTSB: This FORTRAN module provides detailed subsonic or transonic flow solution on the hub-shroud mid channel stream surface of a single blade row of turbomachine. The MTSB module is executed consecutively for all stages. Its input is read on logical unit 26. Note that MTSB does not supply directly any data to the neutral file (section C.8).

MTSBPOST: This FORTRAN module post-process data from the MTSB. output file M*typiijj*.OUT. Section C.9 of appendix C shows in details the neutral file data processed by this module.

NOISE: This FORTRAN module is used for the estimation of the fan tone, broad band, and jet noise. Section C.10 of appendix C shows in details the neutral file data obtained and/or generated by this module.

PREDICT: This FORTRAN module predicts gross, airframe, engine, capacity and fuel weights. Section C.11 of appendix C lists in details the neutral file data obtained and/or generated by this module.

RANGE: This FORTRAN module is executed if the defaulted RANGE is zero. Section C.12 of appendix C lists in details the neutral file data obtained and/or generated by this module.

CITY: This FORTRAN module determines the number of city pairs in US. and Western Europe. Section C.13 of appendix C lists in details the neutral file data obtained and/or generated by this module.

REPAIR: This FORTRAN module estimates mean time between engine repair, engine materials, and labor maintenance time and costs. Section C.14 of appendix C lists in details the neutral file data obtained and/or generated by this module.

DOC: This FORTRAN module is used for direct operating costs computations of aircraft including airframe and engine. A long list of parameters are computed or updated by this module beginning from cruise altitude ALT and ending with international spare prop depreciation CDPI. Section C.15 of appendix C lists in details the neutral file data obtained and/or generated by this module.

LCC: This FORTRAN module is used for cost estimation for a given year of service. The list of parameters computed by this module and placed in the neutral file begins with new jet/fan maintenance cost for first year of service NEWT1 and ends with derivative reciprocating eight year total DERRENG. These parameters are used in the computation of the projected cost for turboprop, turbojet, turbofan, and reciprocating engines. The projected cost is given as a function of year, up to 12 years. Section C.16 of appendix C lists in details the neutral file data obtained and/or generated by this module.

FLOPSGEN: This FORTRAN module generates the input file *flopsin.file* for the FLOPS module. This file contains NAMELIST input for mission performance and cost analysis. Also, through the neutral file keyword EIFILE, FLOPSGEN specifies the name of a mission data file, *nnepwate.missout*, containing thrust, fuel flow, and specific fuel consumption at various Mach number and altitude sets. Section C.17 of appendix C lists in details the neutral file data obtained and/or generated by this module.

<u>FLOPS:</u> This FORTRAN code is the Flight Optimization System module. It is a multidisciplinary computer code for conceptual and preliminary design and evaluation of advanced aircraft concepts. Two input files, *flopsin.file* and *nnepwate.missout*, are required to run FLOPS. The output from FLOPS is stored in *flopsout.file*. The FLOPS NAMELIST input deck limit the analysis options to mission performance and cost assessment. To select more options, an expert user must modify the input generator FLOPSGEN which requires adding more input and output parameters to the neutral file. Note that the FLOPS module does not supply directly any data to the neutral file (section C.18).

<u>FLOPSPOST:</u> This FORTRAN module post-process the output from FLOPS. It updates the neutral file to include response parameters from mission performance and cost analysis. The mission summary data are printed at various time segments for climb, cruise, and descent. Some of these data are: altitude, weight, fuel flow, and thrust. The cost analysis provides direct and indirect operating cost, manufacturing cost, and return on investment. Section C.19 of appendix C lists in details the neutral file data obtained and/or generated by this module.

<u>PCHART:</u> This module consists of two programs: PIECHART.C and PCHART.F written in FORTRAN and C respectively. The objective of this module is to display in the form of a pie chart engine/airframe direct operating cost. The following items constitute the chart:

- captain and first officer pay
- engine fuel and oil cost
- airframe and engine material and maintenance cost
- airframe and engine depreciation
- spare airframe and engine depreciation

Note that PIECHART.C and PCHART.F are compiled then linked together to form a single executable. The input to this module is the neutral file.

<u>BCHART:</u> This module consists of two programs: BARCHART.C and BCHART.F written in FORTRAN and C respectively. The objective of this module is to display in the form of bar charts the mean time between repairs and the FTE repair hours cost for the following engine components: inlet, low pressure compressor, high pressure compressor, diffuser, combustor, high pressure turbine, low pressure turbine, nozzles, and shafts.

Note that the BARCHART.C and BCHART.F are compiled then linked together to form a single executable. The input to this module is the neutral file.

4.2 Format and Content of the T/BEST Neutral File

The neutral file is a central data bank system that is used as a dispository to exchange information among all modules in T/BEST. The neutral file, named *neutral.file*, resides under /user/tbest/in sub-directory. The first two lines in this file are used as a heading. Every parameter in the neutral file is represented by a unique keyword located from the 31st column to the 40th. The types of data available in the neutral file are listed below:

1. Integer with the format: 40x,i5. The integer keywords are: NCC, NSTAGE, NS, NB, IOPT, IANAL, ICOST, NVERT, NFUSE, NEW, NEF, NPF, NPT, NSTU, NGALC, NFLCR, IDLE, IGENEN, IFLAG, MSUMPT, IRW, IATA, ITTFF, IOC, NINDE, MYWTS, ICOSTP, IRAD, NPROTP, NFLTST, IBODY, ICIRC, NCHAN, NGEN, NPOD, IMUX, and ISPOOL.

2. Character with the format: 40x,a15. The character keywords are: AIRCODE, ABLDEF, TYPROC, DISMAT, EIFILE.

3. All the remaining keywords in the neutral file depicts parameters with real data type with the format: 40x, e12.5.

4. Keywords may be used to point to additional files that contain copious amount of data.

The T/BEST neutral file is a single file subdivided into blocks. Keywords may be added to any of these blocks. However, it has been determined that T/BEST execute faster if relevant data are grouped together, that is, for example, the DOC data is intermixed with the structural analysis results, a substantial amount of time is spent searching for DOC keyword. Therefore, the usage of these "blocks" of data is advantageous. Section A.5 of appendix A lists a sample neutral file.

<u>Block # 1:</u> Data for all engine components is found in this block. Engine components such as fans, compressors, and turbines contain stages while others such as inlet, burner and duct, do not. For fans, compressors, and turbines, detailed stage data is listed in the neutral file. Component data (speed, length etc.) comes ahead of stage data (blade dimensions and material type). The parameters used to describe compressors or turbines and their corresponding stages are similar to those used for fans. Component number and type are used to identify data associated with fans, compressors, and turbines.

The parameters used to describe the stage in the neutral file are obtained from NNEPWATE, BLASIM, and MTSB. From the stage number NS to the keyword MATSLC are obtained from NNEPWATE output. The next two parameters AIRCODE and ABLDEF are set by default in the file. Data beginning with the blade untwist UTWIST to the impact root damage function ROOTD are obtained from BLASIM while the efficiencies that follow come from MTSB.

Block # 2: The second data block contains parameters for direct operating cost. These parameters are set by default may be changed at the start of the execution of T/BEST as seen in the previous section. This block is titled "GLOBAL VARIABLES 1 - AIRCRAFT - DOC".

Block # 3: The third data block lists various parameters that can be used for noise estimation. Parameters with the keywords XFLOW, XVR, XRPM, XGAP, XCHORD, RI and RO are extracted from the NNEPWATE output while the remaining variables are set by default. This block is titled "GLOBAL VARIABLES 2 - NOISE "

Block # 4: The parameters described here are obtained from the NNEPWATE output and extracted for the corresponding cruise altitude and Mach number. The data here pertains to parameters used in mission analysis (thrust, fuel, velocity, etc....). Also, for each component, inlet and outlet temperatures and pressure are given.

Block # 5: This block begins with the cruise altitude ALT and ends with the low pressure turbine materials cost LTCOST. This segment of the neutral file is dedicated for repair, maintenance and cost data of the aircraft. This block of data is initialized (defaulted) at the start of T/BEST execution and stored in *neutral.add* file located in */user/tbest/in* sub-directory (section C.1 of appendix C). The parameters in this block may be updated as demonstrated in section 3.0. Changing the actual values of defaulted parameters is carried out during the execution of NEUTGEN if *neutral.add* file did not pre-exist.

Block # 6: This block contains data for the FLOPS module. It begins with the heading "BEGIN FLOPS DATA" and ends with "END FLOPS DATA". The data included in this block pertains to mission performance and cost analysis input and output as described in sections C.17, C.18, and C.19 of appendix C.

4.3 T/BEST Shell Script

The execution of T/BEST is managed and controlled by a shell script named *tbest.exe*. The script is a Bourne shell which is equivalent to a set of command language interpreter. With the Bourne shell, compilation is not required and its commands can be directly executed. In the shell script, the execution of T/BEST modules starts with NEUTGEN in a clockwise sequence and ends with BCHART as shown in Figure 4.1. A complete listing of the T/BEST shell script is given in section D.1 of appendix D.

4.4 Compilation and Linking of T/BEST Modules

The compilation and linking commands, shown in bold letters, are valid on all SGI workstations with IRIX operating system (version of UNIX).

To compile a FORTRAN module:	f77 -c -static code.f
To link the object file of the FORTRAN module:	f77 -o exe code.o
To compile a C module:	cc -c source.c
To link the object file of the C module:	cc -o exe source.o

To link FORTRAN and C together (applies for PCHART and BCHART):

f77 -o exe source.o code.o -lgl_s

A unique compilation and linking capability has been embedded in the T/BEST executive system. Any module in T/BEST which executable does not exist in the T/BEST exe sub-directory is automatically compiled and linked. This capability is very helpful, especially when loading T/BEST on workstations that operate under various operating system. A file that contains a listing of all modules in T/BEST is located in the */user/tbest* mother directory. This file is named *list.exefiles.* A listing of this file is shown in section D.2 of appendix D. Note that the executable of every T/BEST module is named *module.exe.*

4.5 T/BEST Blade Material Data Bank

The BLASIM module in T/BEST performs structural analyses on fan, compressor and turbine blades. For now, it is assumed that the blade is made-up of a single material (solid blades). However, BLASIM is capable of handling additional types of blades: superhybride, hollow, and composite. The material properties for composite blades [Ref. 2] are computed via ICAN [Ref. 10] which is included in BLASIM. The single material that is used to construct the blade is selected among any matrix that is listed in the data bank (section D.3 of appendix D).

SECTION 5.0

DESCRIPTION OF DEFAULT T/BEST ANALYSES MODULES

5.1 Thermodynamic and Flow Path Analysis (NNEPWATE Module)

The NNEPWATE [Ref. 1] module is a FORTRAN code that combine two NASA LeRC in-house computer programs:

1. NNEP89 [Ref. 1.a] : Navy/NASA engine program used for engine cycle analysis.
2. WATE89 [Ref. 1.b]: Weight Analysis of Turbine Engines.

5.1.1 Thermodynamic Engine Cycle Analysis (NNEP89)

The NNEP89 code conducts one dimensional steady state thermodynamic analysis of turbine engine cycles. In the NNEP89 input file, a set of standard components are connected to simulate almost any turbine engine configuration. Off-design performance is calculated through the use of component performance maps. The compressor and turbine performance maps are scaled by the code to match the design point pressure ratio, corrected weight flow and efficiency of the engine being modeled. The NNEP89 code allows the user to model multimode engines that change configurations over various portions of their flight regimes. By default, the thermodynamic routine in the code is preset for mixtures of air and JP4 fuel. An optional chemical equilibrium model can predict thermodynamic properties when chemical dissociation occurs as well when using virtually any fuel.

In general, two input files are required to execute the NNEP89 code. The first contains inputs which indicate what components will be used and how those components are configured to form a specific engine model. Detailed inputs for each of these components describe the desired component model. Also included in this input file are global inputs which control program input/output, execution, optimization, turbine cooling, thermodynamic property calculations, and installation effects calculations. The second input file contains all performance map tables which are generally used to model off design performance of components such as compressors and turbines. The capability of NNEP89 is extended beyond thermodynamic analysis by coupling it to the WATE code.

5.1.2 Initial Engine Sizing (WATE89)

The WATE89 code has been developed to estimate an initial engine weight from corrected data and major envelope dimensions of large axial flow aircraft jet engines and small gas turbine engines. The code determines the weight of each major component in the engine, such as compressors, burners, turbines and frames. A preliminary design approach is used where the stress level, maximum temperature, material, geometry, stage loading, hub-tip ratio, and shaft mechanical overspeed are used to determine the component weight.

A relatively high level of detail was found to be necessary in order to obtain a total engine weight within a reasonable accuracy. Component weight data for many engines were used as a data base to develop the method for axial flow aircraft engines. The list of engines includes military and commercial, turbofans and turbojets, augmented and dry, supersonic and subsonic, and small gas turbines. A thermodynamic simulation of each engine in the data base was made in order to obtain correlated airflows, temperatures, pressures, etc., data on each component.

The input file for the NNEPWATE code consists of two parts: input for NNEP89 followed by the input for WATE89.

5.2 Blade Assessment for Ice Impact (BLASIM Module)

BLASIM [Ref. 2] (BLade ASsessment with Ice iMpcat) is a NASA LeRC computer code written in FORTRAN 77 for the structural analysis of engine blades. The analysis capabilities of the BLASIM code are: local and root ice impact damage, local and root Foreign Object Damage (FOD), static, dynamic, resonance margin calculations, flutter, and fatigue. BLASIM can handle the following blade types: solid, hollow, superhybrid and composite. The solid blade is made up of a single material where as hollow and superhybrid blades are constructed with prescribed composite lay-up. For composite blades, BLASIM utilizes ICAN (Integrated Composite ANalyzer [Ref. 10]) to generate the temperature/moisture dependent ply properties of the composite blade.

Two types of geometry input can be given: NASTRAN type finite element grid or airfoil coordinates. This option increases the flexibility of the program. But in T/BEST, the BLASIM code input is generated based on a selected airfoil or full blade geometry (detailed airfoils) entered in the airfoil data bank.

In T/BEST, the BLASIM code is used to analyze every row of rotor blades for each stage of each fan, compressor and turbine. By default, the analyses include most of the general capabilities of BLASIM. The foreign object damage option is optional and is activated by selecting a foreign object velocity, density and size. The impact location is determined based on two fractions determining the upper and lower bounds for the impact region. The values of the foreign object damage parameters are set to zero in the neutral file. Once these parameters are updated, the input to the BLASIM code will include this option.

5.3 Meridional-Transonic Boundary Layer Fluid Analysis (MTSB Module)

MTSB [Ref. 3] is a NASA LeRC computer program that is developed to obtain a detailed subsonic or transonic flow solution on the hub-shroud mid channel stream surface of a single blade row or turbomachine. The flow must be essentially subsonic, but there may be locally supersonic flow. The blade row may be fixed or rotating, and the blades may be twisted and leaned. The flow may be axial, mixed, or radial. Upstream and downstream flow conditions can vary from hub to shroud, and provision is made for an approximate correction for loss of stagnation pressure. Viscous forces are neglected along solution mesh lines running from hub to tip.

The basic analysis is based on the stream function and consists of the solution of the simultaneous, nonlinear, finite difference equations of the stream functions. This basic solution, however, is limited to strictly subsonic flow. When there is locally supersonic flow, a transonic solution must be obtained. The transonic solution is obtained by a combination of a finite-difference, stream function solution and a velocity gradient solution. The finite-difference solution at a reduced mass flow provides information that is used to obtain a velocity-gradient solution at the full mass flow. The blade geometry used in the execution of the MTSB module is again based on the airfoil selected from *airfoil.bank* file.

The MTSB output file provides the neutral file for each stage of each rotating component with detailed efficiencies: kinetic or overall, profile, endwall, section loss, incidence, clearance, windage, and sum rotor.

5.4 Noise Analysis (NOISE Module)

This module estimates the fan tone, broadband, and jet noise [Ref. 4] for turbojet and turbofan propulsion systems. Attenuation lining characteristics, attenuation spectra, are indicated for obtaining the required target perceived noise level (Pndbl). The inputs to the program are the fan flow rate, tip relative speeds, rotor stator axial gap, blade count, jet velocity, nozzle area and length, ambient temperature, relative humidity, inlet and aft duct flow areas, and target perceived noise level. The output is the perceived noise level (Pndbl) at 500 ft. sideline distance and at 50 and 120 degrees from the engine axis. The required lining attenuation characteristics, attenuation as a function of frequency, are indicated in the scratch output file, *noise.scratch2*, in the */usr/tbest/work* sub-directory.

5.5 Statistical Predictions (PREDICT Module)

This module [Ref. 5] estimates the gross, airframe, engine, capacity and fuel weights of aircraft given any one or more of these variables. The role of the PREDICT program is to yield reasonable estimates of the above parameters when none are given. The estimates are obtained from linear regression analyses (using SAS) of a data set containing specification of 31 aircraft and 21 engines covering a gross weights from 90700 to 870000 lbs, two to four engines, cruise speeds from 566 miles per hour to MACH 0.85, ranges from 1120 to 8720 miles, thrust levels from 14000 to 61500 lbs, and capacities from 30700 to 243500 lbs.

Over seventy linear regression equations have been developed and these can be obtained directly from the source code along with their respective correlation coefficients. Section D.2 of appendix D contains a listing of the data base used in the PREDICT module.

5.6 Range Analysis (RANGE)

This module determines the Brequet [Ref. 6] range and includes a corrected range determined from historical data. This corrected range is based on the results of a linear regression analysis of actual flight ranges data versus ranges predicted by the Brequet range. The data base used for the regression analysis is same as that is used in the PREDICT module. The corrected data is not meant to indicate that the Brequet ranges are invalid. The corrected range is indicated to be more representative for the more complex flight paths of commercial aircraft. The inputs are the specific fuel consumption, cruise velocity, lift to drag ratio, and take-off and landing weights.

5.7 City Pairs (CITY Module)

This module [Ref. 7] determines the number of city pairs in the United States and Europe that can be reached given the range of the aircraft. The data for the United states is incomplete and needs to be extended to include city pairs greater than 3000 miles.

5.8 Maintenance Between Repair (REPAIR Module)

This module estimates the mean time between repair, engine materials and labor maintenance costs from historical data. The correlations are from "A New Method for Estimating Transport Direct Operating Costs" [Ref. 8]. The input data includes fan, low and high pressure compressor and turbine, and combustor inlet and exit temperatures and pressures. The fan, low and high pressure compressor and turbine diameters, rotations per minute and first stage tip speeds, etc. are input to the program in addition to the acquisition cost (price) of a replacement component, e.g., low pressure compressor price. The output of the program are the mean time between repair, repair hours, and repair cost.

5.9 Direct Operating Cost (DOC Module)

This module estimates the direct operating costs (DOC) of aircraft (reciprocating engine, turboprop, turbofan , and turbojet) airframe and engines. The model is from the Air Transportation Association and should be upgraded to the current date. The reader should refer to "Standard Method of Estimating Comparative Direct Operation Costs of Transport Airplanes" [Ref. 9]. Typical inputs included the total fuel consumed, Civil Aviation Board trip length, number of engines, gross, landing, and engine weights, engine thrust, ground speed, specific fuel consumption, acquisition, fuel and oil costs, and insurance, crew, depreciation rates, etc. The outputs are indicated in $/mile and include the crew, fuel, engine and airframe maintenance material, labor, and burden costs. Depreciation of spare parts and equipment and insurance costs are also available. Both domestic and international costs are indicated.

5.10 Life Cycle Maintenance (LCC Module)

This module estimates the engine maintenance costs [Ref. 8], per aircraft, for a given year. The engine maintenance costs used in the determination of the engine and airframe direct operating costs are those costs where the engine maintenance costs are approximately constant per year, i.e., about the 9th year of engine service. The inputs are the number of engines per aircraft, block time and block speed, and the ninth year direct operating maintenance costs. The outputs include estimates of the engine maintenance costs as a function of the year of service and whether the engine is a derivative engine or a new technology engine.

5.11 Flight Mission Summary (FLOPS Module)

FLOPS [Ref. 11] release 5.4 is included in T/BEST for mission and cost analyses. The FLOPS module, written in FORTRAN and developed at NASA Langley Research Center, consists of nine primary modules: weights, aerodynamics, engine cycle analysis, propulsion data scaling and interpolation, mission performance, takeoff and landing, noise footprint, cost analysis, and program control. For now, two FLOPS capabilities, mission performance and cost analysis are used in T/BEST.

The FLOPS mission performance capability uses the calculated weights, aerodynamics, and the NNEPWATE propulsion system data to calculate performance. Optimum climb profiles may be flown to start of cruise conditions. The cruise segments may be flown at the optimum altitude and Mach number for maximum range. Descent may be flown at the optimum lift-drag ratio.

The cost analysis capability expands beyond what is obtained through the DOC module discussed in section 5.9. The FLOPS cost capability includes detailed airframe costs, engine development and production costs, direct and indirect operating costs, fare cost, and return on investment.

SECTION 6.0

PARAMETRIC STUDIES

The T/BEST neutral file provides the user with results for all analyses modules. But in this section, results from BLASIM, MTSB, and FLOPS obtained at the end of a typical T/BEST run are plotted to show the user how to process and interpret some neutral file data. Emphasis is placed on blade structural response parameters, efficiencies obtained through flow analysis, and mission performance.

6.1 Blade Structural Response

The BLASIM module is responsible for conducting structural analysis of fan, compressor and turbine blades. Data from the following analyses capabilities are listed in neutral file: static, modal, fatigue, resonance margin, and foreign object damage. The structural response shown here is restricted to data for the high pressure compressor (HPC). It is the fifth component in the engine and contains five stages.

Figure 6.1 shows the root static stress for each stage and the modified Distortion Energy Criterion (MDE) function response [Ref. 10]. Failure will occur if the MDE function is greater than 1.0.

Figure 6.2 shows the untwist and uncamber of the blade at all stages of the compressor. The blade is constructed with NACA 64-206 airfoils.

Natural frequencies for the first five modes at the operating speed(7648 rpm) are shown in Figure 6.3. Note that the T/BEST neutral file lists also the frequencies at minimum and maximum rotor speeds.

6.2 Efficiencies for the High Pressure Compressor

The efficiencies shown here are those obtained for all the stages of the high pressure compressor. Figure 6.4 shows the efficiency change due to profile, endwall, secondary loss, incidence, clearance and windage. The overall efficiency for all five stages is plotted in Figure 6.5. Note that the overall efficiency decreases from 89.4% at the first stage to 76.6% at the last stage.

6.3 Mission Summary

The FLOPS module provide the neutral file of the T/BEST executive system with detailed mission performance at all flight segments: climb, cruise, and descent. Two responses at all flight segments have been plotted in this section: Mach number (Figure 6.6) and aircraft gross weight (Figure 6.7). The aircraft gross weight decreases as the flight time increases because the fuel is being consumed.

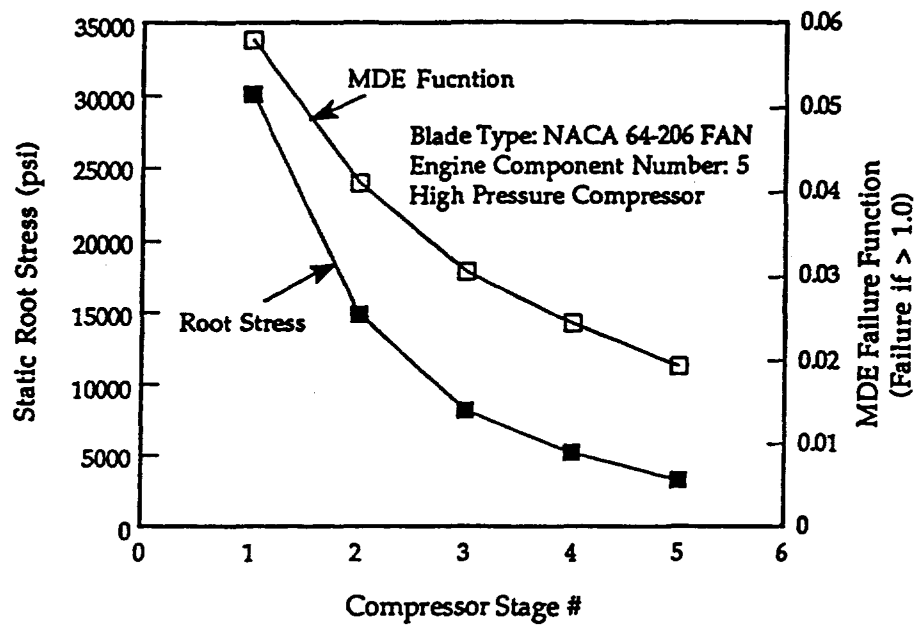

Figure 6.1 Blade Structural response: Static Root Stress Level and MDE Failure Function

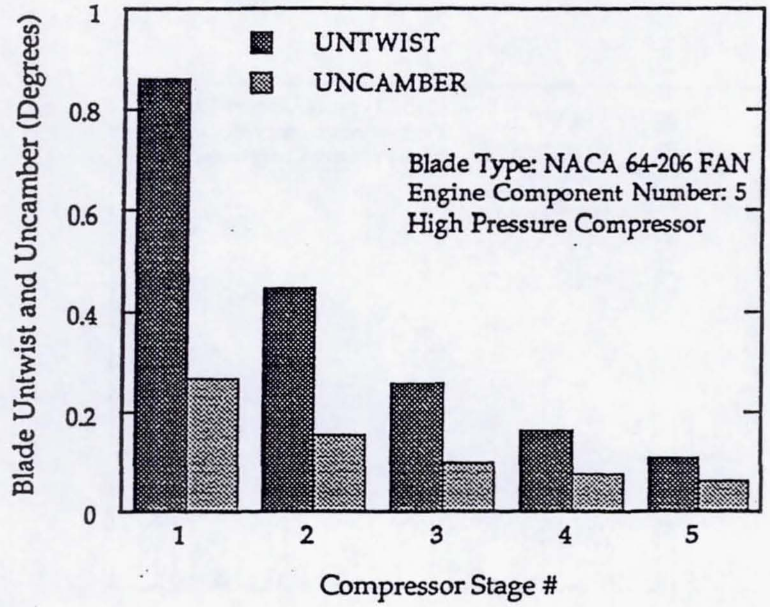

Figure 6.2 Blade Structural response: Untwist and Uncamber

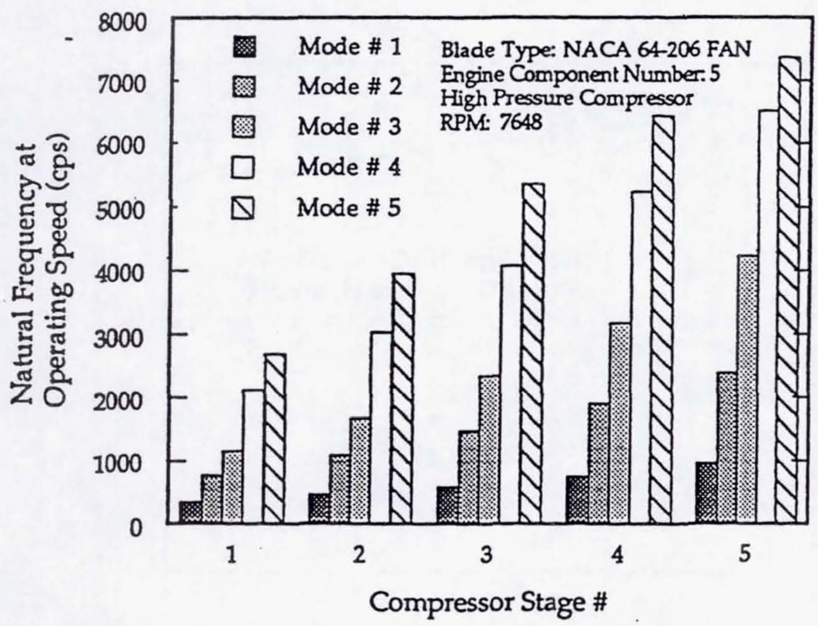

Figure 6.3 Blade Modal response: Natural Frequencies of the First Five Modes

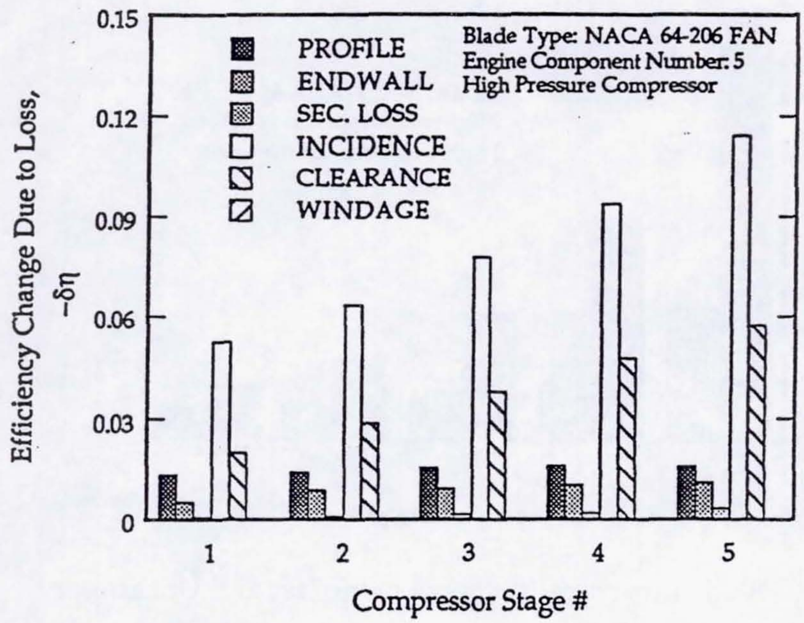

Figure 6.4 Compressor Efficiency Changes Due to Loss

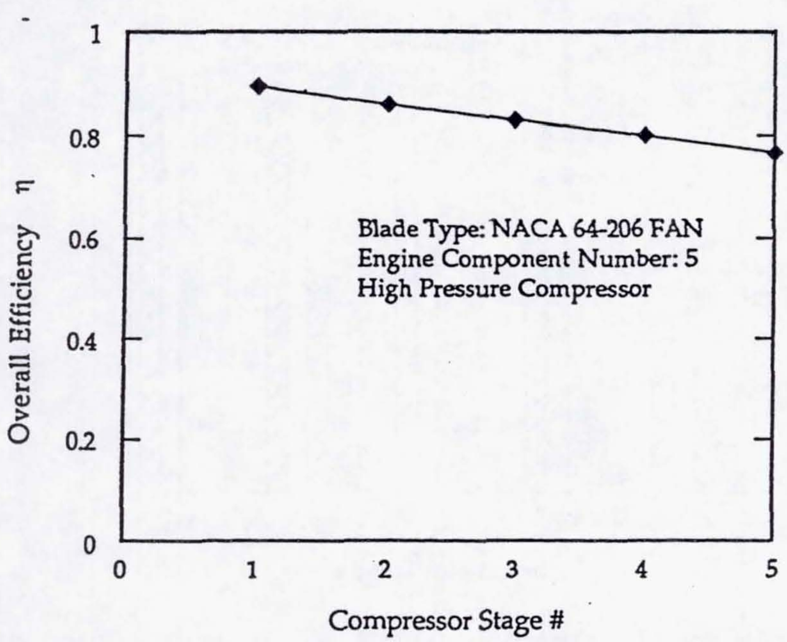

Figure 6.5 High Pressure Compressor Stages Overall Efficiency

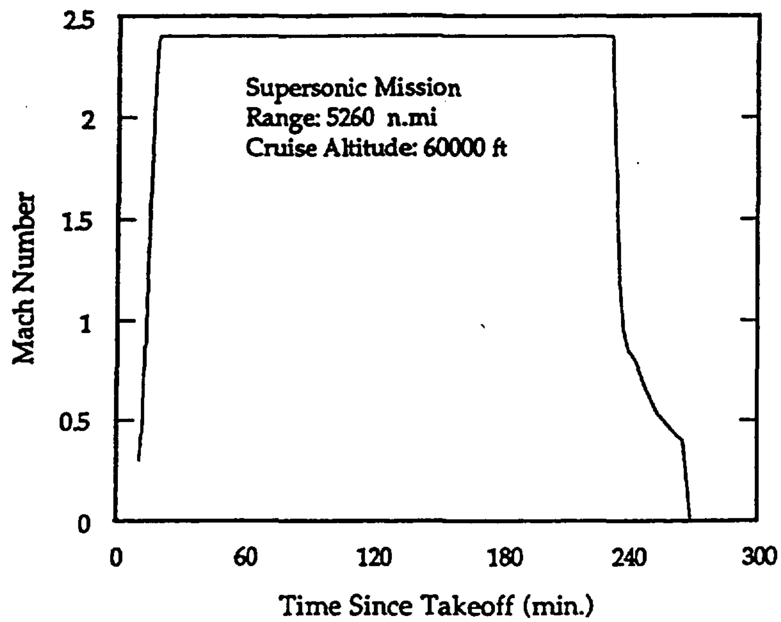

Figure 6.6 Mission Performance: Mach Number at Climb, Cruise, and Descent.

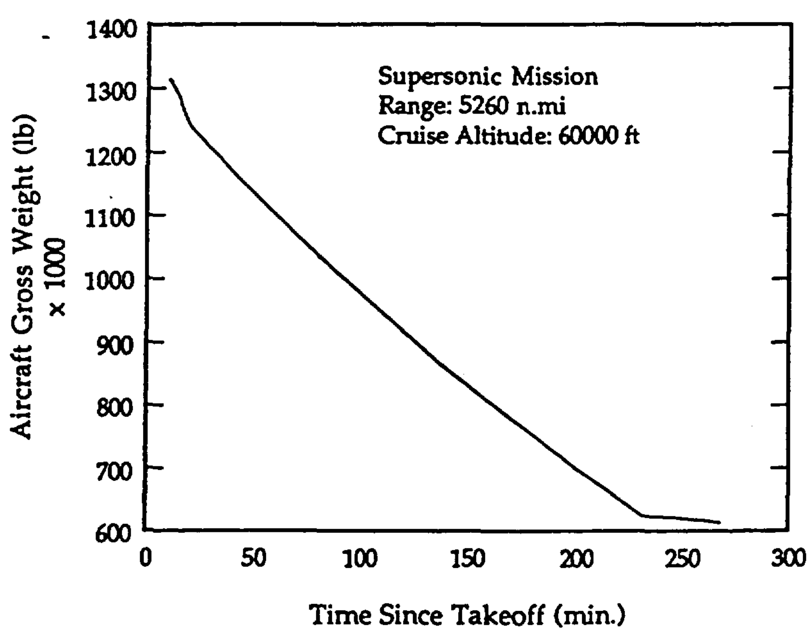

Figure 6.7 Mission Performance: Aircraft Gross Weight at Climb, Cruise, and Descent.

SECTION 7.0

REFERENCES

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6. Page, R. K., "Range and Radius-of-Action Performance Prediction for Transport and Combat Aircraft", in Aircraft Performance - Prediction Methods and Optimization, AGARD-LS-56, 1972.

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APPENDIX A

DESCRIPTION OF DEMONSTRATION EXAMPLE

A.1 Description of the Supersonic Engine

The example used here pertain to a high speed aircraft with maximum velocity of 2.4 Mach number and cruise altitude of 60000 ft. The aircraft is capable of carrying up to 250 passengers with a range of 5000 nautical mile. The supersonic engine operates under constant design thrust with scale factor on corrected weight flow of 0.999.

The NNEPWATE module is used for engine cycle analysis and weight estimation. Here, it is required to provide the mechanical and thermodynamic connection of the engine in consideration through a set of inputs. To execute NNEPWATE, two files are required: engine input and performance map files. Complete details on input files generation for the NNEPWATE code are found in reference [1].

A block diagram of the engine in consideration is shown in Figure A.1. Engine components 2 and 5 characterize a fan and a high pressure compressor consisting of two and five stages respectively. But engine components 8 and 9 depict a high and a low pressure turbines with one and two stages respectively. The flow splits at the third engine component and ends in a nozzle (component number 14). Ducts or burners in Figure A.1 are defined using the keyword "DUCT B". Only engine component number 7 is a burner and the remaining "DUCT B" components are ducts to bypass the flow. The NNEPWATE input and map files are listed in sections A.3 and A.4 of this appendix.

The output file obtained when running NNEPWATE has the extension ".output" and is stored permanently in the T/BEST output sub-directory. The NNEPWATE output file provides the T/BEST neutral file with thermodynamic properties of the flow at each station in addition to weight and length of each components through the engine. Also, the output file provides general parameters that can be used in the construction of the fan, compressor, and turbine blades. . These parameters are: hub to tip ratio, hub and tip radii, and the blade aspect ratio.

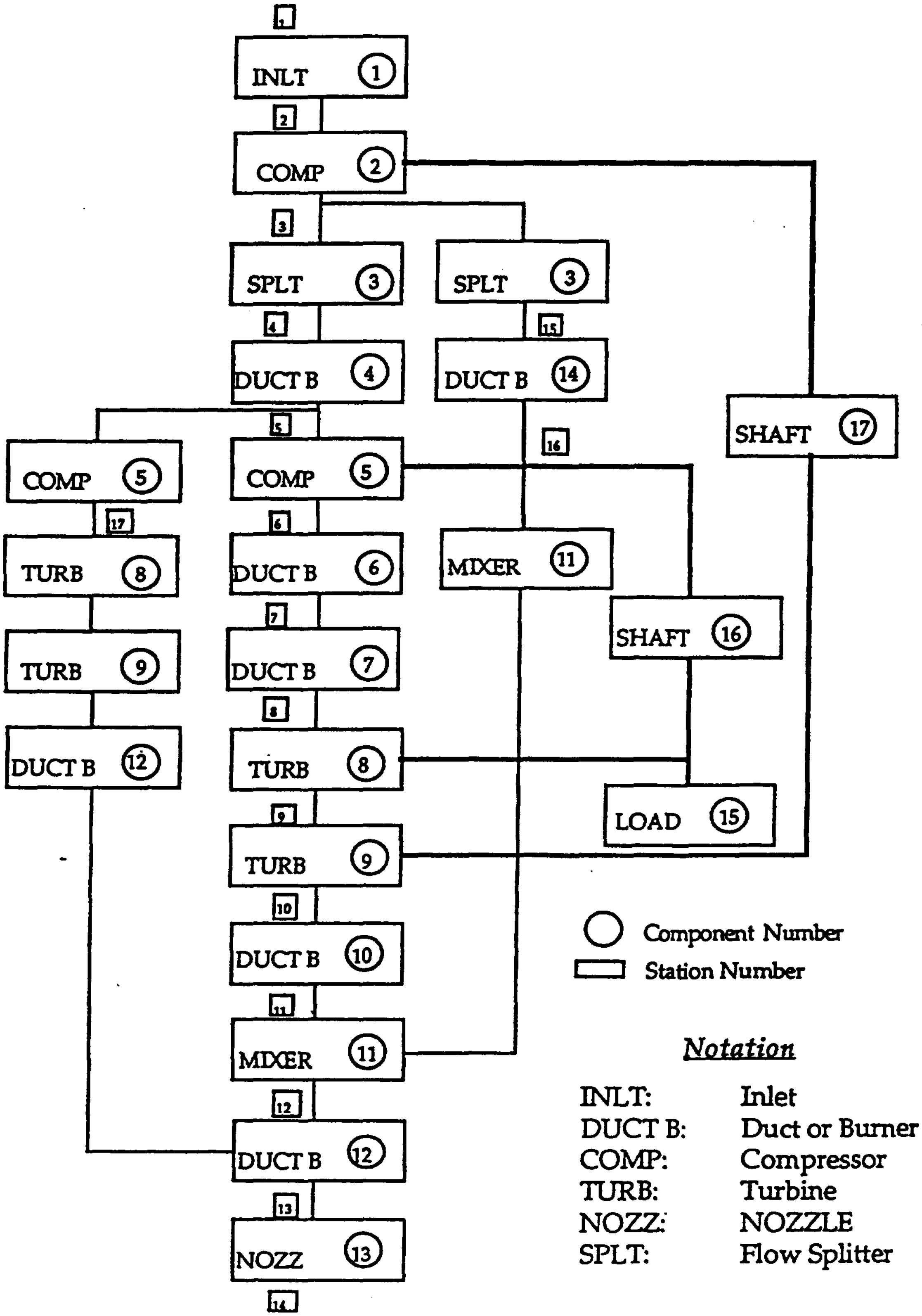

Figure A.1 Block Diagram of a Supersonic Research Engine

A.2 Construction of Fan, Compressor and Turbine Blades

The blade constitutes the most fundamental element of engine rotating components (fan, compressor, and turbine). Structural failure of the blade can cause the engine to fail and subsequently placing the passengers as well as the aircraft at risk. The blade structural analysis is done using the BLASIM code. Prior to analyzing the blade, a complete geometric description is required. Several blade geometric parameters such as aspect ratio, hub to tip ratio, and hub and tip radii are obtained from the NNEPWATE output file then stored in the T/BEST neutral file. These parameters are taken into account when generating the blade geometry.

An airfoil data bank is used as a basis for the full construction of the blade. The user may store and update pre-defined airfoils or may provide the full blade geometry in the airfoil data bank file named *airfoil.bank.*. This capability allows the user to build-up a library of airfoils that can be used efficiently in engine component design. The airfoil data bank file resides in the *tbest/in* sub-directory.

In this example, blade geometry is needed for the following components:

1. Component number 2 (two stages), type: fan
2. Component number 5 (five stages), type: high pressure compressor
3. Component number 8 (one stages), type: high pressure turbine
4. Component number 9 (two stages), type: low pressure turbine

Figure A.2 shows a plot of the NACA 64-206 airfoil that is used to generate the geometry at each stage for the rotating components that are listed above. Note that the fan and compressor use the same airfoil. The format and content of the airfoil data bank are fully decribed in appendix B. The airfoil used in this example is the defaulted one in T/BEST. The airfoil data bank is flexible enough to allow the user to add new airfoils. The airfoil data bank accepts two types of blade definition: airfoil and full geometry of the blade.

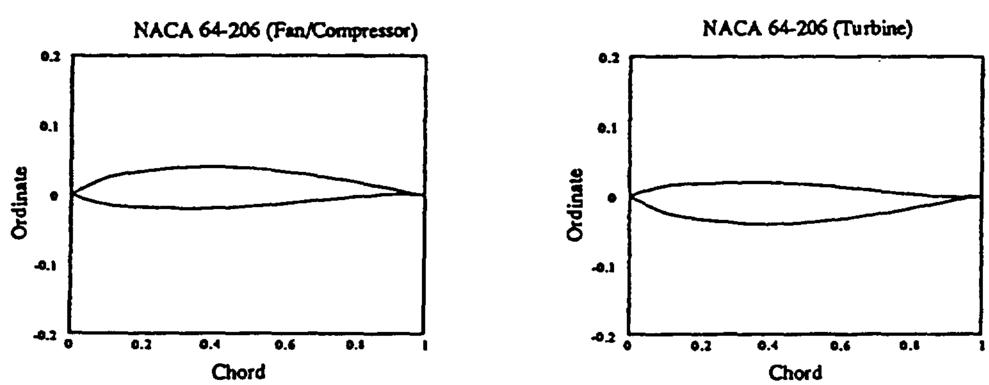

Figure A.2 Default Airfoil Used for Fan, Compressor and Turbine Blades

A.3 Listing of *supersonic.input*

The NNEPWATE module consists of two combined codes: NNEP for engine cycle analysis and WATE for weight estimation [Ref. 1]. The input file to NNEP and WATE is combined in a single file with the extension ".input".

The first block of the input file is associated with the NNEP input. The input begins with a global namelist where the following categories may be defined: input and output options, execution control, optimization, turbine cooling, and thermodynamic properties.

Here the user must specify the components that make up the engine. Flow stations for flow leaving and entering a component must be defined as well. These flow stations inform the NNEP code how the engine components are connected. Some restriction apply in assigning the component and station numbers. For example, the primary inlet must always be given a component number of one. The KONFIG array is used to provide the information needed to define the configuration of the engine. In this example, the first numeric value of the KONFIG array identifies the component type used. For more details, refer to the NNEP code user's manual.

The second block of this input file is associated with the WATE input. The IWMEC and DESVAL arrays are used in providing the WATE input for the components defined in the first block. For example, if the component type is fan/compressor, the IWMEC array can be used to specify indicators for stator, frame, and gear box. For the same component, the DESVAL array is used to specify: entrance MACH number, blade material density and aspect ratio, and compressor design type etc.. For a complete description of the WATE input, refer to the WATE code user's manual [Ref. 1].

```
TF3 - INSTALLED ENGINE MATRIX (FULL & PART POWER)
&D AMAC=T,MAPLOT=F,NMODES=1,MODESN=1,NCODE=-1,LONG=F,DOUTHD=T,
CALBLD=F,MAXNIT=100,ITERM=0,T4TOC=3499,P4TOC=193.5,WATOC=186.9,
T3MAX=1710,BOAT=T,IWT=1, &END
&D MODE=1,
/* UPDATED MAY 94 TO GENERATE FLOPS MISSION DATA */
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0,0,.873,3.8,.995,
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KONFIG(1,4)=2, 4, 0, 5, 0,SPEC(1,4)=8*0,
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1,.18,.898,3.5,1.,
KONFIG(1,6)=2, 6, 0, 7,18,SPEC(1,6)=8*0,.0035,
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.140,0,5,
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.523,1,.905,5680,1,0,1,
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.0,0,0,
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0.80,11,5531.,
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KONFIG(1,15)=10, 0, 0, 0, 0,SPEC(1,15)=-200.,
KONFIG(1,16)=11, 5, 8,15, 0,SPEC(1,16)=1,8*1,
KONFIG(1,17)=11, 2, 9, 0, 0,SPEC(1,17)=1,8*1,
/*              Design Point CNTLs                    */
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KONFIG(1,19)=12,SPCNTL(1,19)=1,5,200,5,5,25.01,1,
KONFIG(1,20)=12,SPCNTL(1,20)=1,2,200,5,2,20.01,1,
/*            CNTLs That are Always On                */
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/*               Off-Design CNTLs                     */
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/*            CNTLs Activated by VCNTs                */
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/*           CNTLs For Part Power Oper.               */
KONFIG(1,32)=12,SPCNTL(1,32)=4,7,400,3,0,20000,0,1000,3750,
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```

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&END
&D MACH=   .00,ALTP=     0.,ETAR= .9320,MODE= 1,NVOPT=  0,IWT= 1,INST= 0,
SPEC(2,11)=  .346566D+03,SPEC(1,9)=  .183293D+01,SPEC(1,8)=  .251027D+01,
SPEC(4,7)=  .337509D+04,SPEC(9,6)=  .340143D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .148362D+01,SPEC(1,3)=  .559823D+00,SPEC(1,2)=  .133689D+01,
SPEC(14,1)=  .650000D+03,SPEC(1,16)=  .101344D+01,SPEC(1,17)=  .101721D+01,
SPEC(1,22)=  .106559D+01,SPEC(5,34)=  .200000D+02,SPEC(8,13)=  .112282D+01,
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SPEC(9,23)=1,SPEC(9,24)=1,SPEC(9,25)=1,SPEC(9,26)=1,
SPEC(9,27)=1,SPEC(9,28)=1,SPEC(9,29)=.005,SPEC(9,30)=0,
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SPEC(2,11)=  .331311D+03,SPEC(1,9)=  .186499D+01,SPEC(1,8)=  .251983D+01,
SPEC(4,7)=  .331733D+04,SPEC(9,6)=  .348087D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .149024D+01,SPEC(1,3)=  .596194D+00,SPEC(1,2)=  .137304D+01,
SPEC(14,1)=  .649977D+03,SPEC(1,16)=  .100848D+01,SPEC(1,17)=  .101638D+01,
SPEC(1,22)=  .110394D+01,SPEC(5,34)=  .226935D+02,SPEC(8,13)=  .110276D+01,
&END
&D MACH=   .00,ALTP=     0.,ETAR= .9320,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .263860D+03,SPEC(1,9)=  .202276D+01,SPEC(1,8)=  .255548D+01,
SPEC(4,7)=  .309229D+04,SPEC(9,6)=  .358107D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .151150D+01,SPEC(1,3)=  .635216D+00,SPEC(1,2)=  .134877D+01,
SPEC(14,1)=  .647249D+03,SPEC(1,16)=  .993734D+00,SPEC(1,17)=  .101174D+01,
SPEC(1,22)=  .133212D+01,SPEC(5,34)=  .209775D+02,SPEC(8,13)=  .105402D+01,
&END
&D MACH=   .00,ALTP=     0.,ETAR= .9320,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .301647D+03,SPEC(1,9)=  .202205D+01,SPEC(1,8)=  .256169D+01,
SPEC(4,7)=  .296646D+04,SPEC(9,6)=  .393879D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .151342D+01,SPEC(1,3)=  .736171D+00,SPEC(1,2)=  .145509D+01,
SPEC(14,1)=  .624783D+03,SPEC(1,16)=  .974641D+00,SPEC(1,17)=  .971757D+00,
SPEC(1,22)=  .134905D+01,SPEC(5,34)=  .294708D+02,SPEC(8,13)=  .102581D+01,
&END
&D MACH=   .00,ALTP=     0.,ETAR= .9320,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .320503D+03,SPEC(1,9)=  .198784D+01,SPEC(1,8)=  .256576D+01,
SPEC(4,7)=  .284031D+04,SPEC(9,6)=  .431148D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .151426D+01,SPEC(1,3)=  .790804D+00,SPEC(1,2)=  .147986D+01,
SPEC(14,1)=  .588755D+03,SPEC(1,16)=  .956118D+00,SPEC(1,17)=  .913656D+00,
SPEC(1,22)=  .134966D+01,SPEC(5,34)=  .334638D+02,SPEC(8,13)=  .100974D+01,
&END
&D MACH=   .00,ALTP=     0.,ETAR= .9320,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .337614D+03,SPEC(1,9)=  .194938D+01,SPEC(1,8)=  .257077D+01,
SPEC(4,7)=  .272100D+04,SPEC(9,6)=  .471984D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .151495D+01,SPEC(1,3)=  .842326D+00,SPEC(1,2)=  .148033D+01,
SPEC(14,1)=  .553274D+03,SPEC(1,16)=  .938634D+00,SPEC(1,17)=  .854788D+00,
SPEC(1,22)=  .134885D+01,SPEC(5,34)=  .365699D+02,SPEC(8,13)=  .100120D+01,
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&END
&D MACH=   .00,ALTP=     0.,ETAR= .9320,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .348853D+03,SPEC(1,9)=  .189822D+01,SPEC(1,8)=  .257468D+01,
SPEC(4,7)=  .260189D+04,SPEC(9,6)=  .514822D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .151517D+01,SPEC(1,3)=  .879426D+00,SPEC(1,2)=  .145779D+01,
SPEC(14,1)=  .517452D+03,SPEC(1,16)=  .921196D+00,SPEC(1,17)=  .797254D+00,
SPEC(1,22)=  .134192D+01,SPEC(5,34)=  .383853D+02,SPEC(8,13)=  .100093D+01,
&END
&D MACH=   .00,ALTP=     0.,ETAR= .9320,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .372566D+03,SPEC(1,9)=  .178919D+01,SPEC(1,8)=  .255859D+01,
SPEC(4,7)=  .250098D+04,SPEC(9,6)=  .569642D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .150944D+01,SPEC(1,3)=  .907345D+00,SPEC(1,2)=  .141548D+01,
SPEC(14,1)=  .474591D+03,SPEC(1,16)=  .901178D+00,SPEC(1,17)=  .732568D+00,
SPEC(1,22)=  .126482D+01,SPEC(5,34)=  .395136D+02,SPEC(8,13)=  .100566D+01,
&END
&D MACH=   .00,ALTP=     0.,ETAR= .9320,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .385382D+03,SPEC(1,9)=  .173706D+01,SPEC(1,8)=  .254565D+01,
SPEC(4,7)=  .239456D+04,SPEC(9,6)=  .623469D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .150646D+01,SPEC(1,3)=  .950810D+00,SPEC(1,2)=  .138464D+01,
SPEC(14,1)=  .443508D+03,SPEC(1,16)=  .882470D+00,SPEC(1,17)=  .687817D+00,
SPEC(1,22)=  .125630D+01,SPEC(5,34)=  .399739D+02,SPEC(8,13)=  .101885D+01,
&END
&D MACH=   .20,ALTP=     0.,ETAR= .9650,MODE= 1,NVOPT=  0,IWT= 1,INST= 0,
SPEC(2,11)=  .407560D+03,SPEC(1,9)=  .180127D+01,SPEC(1,8)=  .249886D+01,
SPEC(4,7)=  .345605D+04,SPEC(9,6)=  .318635D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .147299D+01,SPEC(1,3)=  .549638D+00,SPEC(1,2)=  .133689D+01,
SPEC(14,1)=  .650000D+03,SPEC(1,16)=  .102052D+01,SPEC(1,17)=  .102127D+01,
SPEC(1,22)=  .102190D+01,SPEC(5,34)=  .200000D+02,SPEC(8,13)=  .116414D+01,
&END
&D MACH=   .20,ALTP=     0.,ETAR= .9650,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .338581D+03,SPEC(1,9)=  .184189D+01,SPEC(1,8)=  .251296D+01,
SPEC(4,7)=  .337918D+04,SPEC(9,6)=  .322493D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .148595D+01,SPEC(1,3)=  .567407D+00,SPEC(1,2)=  .134271D+01,
SPEC(14,1)=  .649594D+03,SPEC(1,16)=  .101583D+01,SPEC(1,17)=  .102030D+01,
SPEC(1,22)=  .107754D+01,SPEC(5,34)=  .204501D+02,SPEC(8,13)=  .114308D+01,
&END
&D MACH=   .20,ALTP=     0.,ETAR= .9650,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .273862D+03,SPEC(1,9)=  .196902D+01,SPEC(1,8)=  .254442D+01,
SPEC(4,7)=  .316605D+04,SPEC(9,6)=  .335862D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .150724D+01,SPEC(1,3)=  .621985D+00,SPEC(1,2)=  .135175D+01,
SPEC(14,1)=  .645455D+03,SPEC(1,16)=  .100029D+01,SPEC(1,17)=  .101244D+01,
SPEC(1,22)=  .125891D+01,SPEC(5,34)=  .212601D+02,SPEC(8,13)=  .108719D+01,
&END
&D MACH=   .20,ALTP=     0.,ETAR= .9650,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .284103D+03,SPEC(1,9)=  .201172D+01,SPEC(1,8)=  .255881D+01,
SPEC(4,7)=  .300684D+04,SPEC(9,6)=  .361016D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .151250D+01,SPEC(1,3)=  .691894D+00,SPEC(1,2)=  .139640D+01,
SPEC(14,1)=  .626365D+03,SPEC(1,16)=  .981986D+00,SPEC(1,17)=  .979001D+00,
SPEC(1,22)=  .134292D+01,SPEC(5,34)=  .253820D+02,SPEC(8,13)=  .105003D+01,
&END
&D MACH=   .20,ALTP=     0.,ETAR= .9650,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .312578D+03,SPEC(1,9)=  .198551D+01,SPEC(1,8)=  .256311D+01,
SPEC(4,7)=  .288708D+04,SPEC(9,6)=  .397412D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .151356D+01,SPEC(1,3)=  .766766D+00,SPEC(1,2)=  .145764D+01,
SPEC(14,1)=  .594180D+03,SPEC(1,16)=  .963700D+00,SPEC(1,17)=  .926783D+00,
SPEC(1,22)=  .134164D+01,SPEC(5,34)=  .315682D+02,SPEC(8,13)=  .102551D+01,
&END
&D MACH=   .20,ALTP=     0.,ETAR= .9650,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .329729D+03,SPEC(1,9)=  .194959D+01,SPEC(1,8)=  .256834D+01,
SPEC(4,7)=  .276574D+04,SPEC(9,6)=  .435024D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .151448D+01,SPEC(1,3)=  .818233D+00,SPEC(1,2)=  .146203D+01,
SPEC(14,1)=  .558627D+03,SPEC(1,16)=  .946128D+00,SPEC(1,17)=  .868098D+00,
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SPEC(1,22)=  .134247D+01,SPEC(5,34)=  .346943D+02,SPEC(8,13)=  .100977D+01,
&END
&D MACH=   .20,ALTP=     0.,ETAR= .9650,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .341291D+03,SPEC(1,9)=  .186884D+01,SPEC(1,8)=  .256807D+01,
SPEC(4,7)=  .264919D+04,SPEC(9,6)=  .476736D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .151341D+01,SPEC(1,3)=  .838162D+00,SPEC(1,2)=  .142311D+01,
SPEC(14,1)=  .515331D+03,SPEC(1,16)=  .927758D+00,SPEC(1,17)=  .800683D+00,
SPEC(1,22)=  .130278D+01,SPEC(5,34)=  .356154D+02,SPEC(8,13)=  .100257D+01,
&END
&D MACH=   .20,ALTP=     0.,ETAR= .9650,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .382045D+03,SPEC(1,9)=  .176861D+01,SPEC(1,8)=  .254939D+01,
SPEC(4,7)=  .255525D+04,SPEC(9,6)=  .531375D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .150663D+01,SPEC(1,3)=  .892603D+00,SPEC(1,2)=  .141519D+01,
SPEC(14,1)=  .476034D+03,SPEC(1,16)=  .907645D+00,SPEC(1,17)=  .737799D+00,
SPEC(1,22)=  .122530D+01,SPEC(5,34)=  .393174D+02,SPEC(8,13)=  .100000D+01,
&END
&D MACH=   .20,ALTP=     0.,ETAR= .9650,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .413309D+03,SPEC(1,9)=  .168711D+01,SPEC(1,8)=  .252190D+01,
SPEC(4,7)=  .245807D+04,SPEC(9,6)=  .588665D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .149775D+01,SPEC(1,3)=  .931452D+00,SPEC(1,2)=  .137745D+01,
SPEC(14,1)=  .438527D+03,SPEC(1,16)=  .886921D+00,SPEC(1,17)=  .684010D+00,
SPEC(1,22)=  .117701D+01,SPEC(5,34)=  .396313D+02,SPEC(8,13)=  .100240D+01,
&END
&D MACH=   .30,ALTP=     0.,ETAR= .9706,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .406029D+03,SPEC(1,9)=  .180130D+01,SPEC(1,8)=  .249850D+01,
SPEC(4,7)=  .348637D+04,SPEC(9,6)=  .307548D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .147286D+01,SPEC(1,3)=  .549724D+00,SPEC(1,2)=  .133689D+01,
SPEC(14,1)=  .650000D+03,SPEC(1,16)=  .102543D+01,SPEC(1,17)=  .102633D+01,
SPEC(1,22)=  .102190D+01,SPEC(5,34)=  .200000D+02,SPEC(8,13)=  .118302D+01,
&END
&D MACH=   .40,ALTP=     0.,ETAR= .9706,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .405972D+03,SPEC(1,9)=  .180137D+01,SPEC(1,8)=  .249802D+01,
SPEC(4,7)=  .352865D+04,SPEC(9,6)=  .295193D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .147277D+01,SPEC(1,3)=  .549834D+00,SPEC(1,2)=  .133689D+01,
SPEC(14,1)=  .650000D+03,SPEC(1,16)=  .103225D+01,SPEC(1,17)=  .103336D+01,
SPEC(1,22)=  .102190D+01,SPEC(5,34)=  .200000D+02,SPEC(8,13)=  .120656D+01,
&END
&D MACH=   .00,ALTP=   689.,ETAR= .9320,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .406269D+03,SPEC(1,9)=  .180111D+01,SPEC(1,8)=  .249923D+01,
SPEC(4,7)=  .341865D+04,SPEC(9,6)=  .345648D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .147309D+01,SPEC(1,3)=  .549544D+00,SPEC(1,2)=  .133689D+01,
SPEC(14,1)=  .650000D+03,SPEC(1,16)=  .101431D+01,SPEC(1,17)=  .101488D+01,
SPEC(1,22)=  .102190D+01,SPEC(5,34)=  .200000D+02,SPEC(8,13)=  .113669D+01,
&END
&D MACH=   .20,ALTP=   689.,ETAR= .9650,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .406259D+03,SPEC(1,9)=  .180120D+01,SPEC(1,8)=  .249899D+01,
SPEC(4,7)=  .344230D+04,SPEC(9,6)=  .325933D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .147298D+01,SPEC(1,3)=  .549600D+00,SPEC(1,2)=  .133689D+01,
SPEC(14,1)=  .650000D+03,SPEC(1,16)=  .101825D+01,SPEC(1,17)=  .101893D+01,
SPEC(1,22)=  .102190D+01,SPEC(5,34)=  .200000D+02,SPEC(8,13)=  .116406D+01,
&END
&D MACH=   .30,ALTP=   689.,ETAR= .9706,MODE= 1,NVOPT=  0,IWT= 1,INST= 0,
SPEC(2,11)=  .406275D+03,SPEC(1,9)=  .180125D+01,SPEC(1,8)=  .249865D+01,
SPEC(4,7)=  .347246D+04,SPEC(9,6)=  .314594D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .147290D+01,SPEC(1,3)=  .549706D+00,SPEC(1,2)=  .133689D+01,
SPEC(14,1)=  .650000D+03,SPEC(1,16)=  .102315D+01,SPEC(1,17)=  .102397D+01,
SPEC(1,22)=  .102190D+01,SPEC(5,34)=  .200000D+02,SPEC(8,13)=  .118291D+01,
&END
&D MACH=   .30,ALTP=   689.,ETAR= .9706,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .342311D+03,SPEC(1,9)=  .183635D+01,SPEC(1,8)=  .251146D+01,
SPEC(4,7)=  .339548D+04,SPEC(9,6)=  .318571D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .148531D+01,SPEC(1,3)=  .565063D+00,SPEC(1,2)=  .133992D+01,
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SPEC(14,1)=  .648246D+03,SPEC(1,16)=  .101803D+01,SPEC(1,17)=  .102060D+01,
SPEC(1,22)=  .107241D+01,SPEC(5,34)=  .202872D+02,SPEC(8,13)=  .116209D+01,
&END
&D MACH=   .30,ALTP=   689.,ETAR= .9706,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .269366D+03,SPEC(1,9)=  .197166D+01,SPEC(1,8)=  .254491D+01,
SPEC(4,7)=  .317659D+04,SPEC(9,6)=  .330545D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .150757D+01,SPEC(1,3)=  .615677D+00,SPEC(1,2)=  .134094D+01,
SPEC(14,1)=  .644964D+03,SPEC(1,16)=  .100289D+01,SPEC(1,17)=  .101461D+01,
SPEC(1,22)=  .126531D+01,SPEC(5,34)=  .204811D+02,SPEC(8,13)=  .110213D+01,
&END
&D MACH=   .30,ALTP=   689.,ETAR= .9706,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .282056D+03,SPEC(1,9)=  .201010D+01,SPEC(1,8)=  .255850D+01,
SPEC(4,7)=  .301931D+04,SPEC(9,6)=  .355969D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .151241D+01,SPEC(1,3)=  .687449D+00,SPEC(1,2)=  .138937D+01,
SPEC(14,1)=  .625507D+03,SPEC(1,16)=  .984420D+00,SPEC(1,17)=  .980382D+00,
SPEC(1,22)=  .134322D+01,SPEC(5,34)=  .249175D+02,SPEC(8,13)=  .106229D+01,
&END
&D MACH=   .30,ALTP=   689.,ETAR= .9706,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .309663D+03,SPEC(1,9)=  .198256D+01,SPEC(1,8)=  .256273D+01,
SPEC(4,7)=  .289874D+04,SPEC(9,6)=  .391748D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .151344D+01,SPEC(1,3)=  .759963D+00,SPEC(1,2)=  .144581D+01,
SPEC(14,1)=  .592803D+03,SPEC(1,16)=  .966071D+00,SPEC(1,17)=  .927247D+00,
SPEC(1,22)=  .134113D+01,SPEC(5,34)=  .308882D+02,SPEC(8,13)=  .103517D+01,
&END
&D MACH=   .30,ALTP=   689.,ETAR= .9706,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .325475D+03,SPEC(1,9)=  .194154D+01,SPEC(1,8)=  .256734D+01,
SPEC(4,7)=  .277686D+04,SPEC(9,6)=  .428853D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .151414D+01,SPEC(1,3)=  .806229D+00,SPEC(1,2)=  .144497D+01,
SPEC(14,1)=  .555749D+03,SPEC(1,16)=  .948325D+00,SPEC(1,17)=  .866839D+00,
SPEC(1,22)=  .133746D+01,SPEC(5,34)=  .335956D+02,SPEC(8,13)=  .101689D+01,
&END
&D MACH=   .30,ALTP=   689.,ETAR= .9706,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .350156D+03,SPEC(1,9)=  .183336D+01,SPEC(1,8)=  .256063D+01,
SPEC(4,7)=  .267169D+04,SPEC(9,6)=  .474988D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .151124D+01,SPEC(1,3)=  .831823D+00,SPEC(1,2)=  .141632D+01,
SPEC(14,1)=  .508876D+03,SPEC(1,16)=  .929090D+00,SPEC(1,17)=  .792822D+00,
SPEC(1,22)=  .125947D+01,SPEC(5,34)=  .356689D+02,SPEC(8,13)=  .100777D+01,
&END
&D MACH=   .30,ALTP=   689.,ETAR= .9706,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .398091D+03,SPEC(1,9)=  .173533D+01,SPEC(1,8)=  .253596D+01,
SPEC(4,7)=  .257880D+04,SPEC(9,6)=  .530426D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .150213D+01,SPEC(1,3)=  .886688D+00,SPEC(1,2)=  .140582D+01,
SPEC(14,1)=  .469351D+03,SPEC(1,16)=  .908166D+00,SPEC(1,17)=  .730525D+00,
SPEC(1,22)=  .118402D+01,SPEC(5,34)=  .391665D+02,SPEC(8,13)=  .100186D+01,
&END
&D MACH=   .30,ALTP=   689.,ETAR= .9706,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .438104D+03,SPEC(1,9)=  .165741D+01,SPEC(1,8)=  .250539D+01,
SPEC(4,7)=  .248292D+04,SPEC(9,6)=  .588707D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .149200D+01,SPEC(1,3)=  .929476D+00,SPEC(1,2)=  .137083D+01,
SPEC(14,1)=  .432468D+03,SPEC(1,16)=  .887129D+00,SPEC(1,17)=  .677484D+00,
SPEC(1,22)=  .113809D+01,SPEC(5,34)=  .394634D+02,SPEC(8,13)=  .100005D+01,
&END
&D MACH=   .40,ALTP=   689.,ETAR= .9706,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .405940D+03,SPEC(1,9)=  .180133D+01,SPEC(1,8)=  .249817D+01,
SPEC(4,7)=  .351455D+04,SPEC(9,6)=  .301953D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .147281D+01,SPEC(1,3)=  .549810D+00,SPEC(1,2)=  .133689D+01,
SPEC(14,1)=  .650000D+03,SPEC(1,16)=  .102995D+01,SPEC(1,17)=  .103099D+01,
SPEC(1,22)=  .102190D+01,SPEC(5,34)=  .200000D+02,SPEC(8,13)=  .120642D+01,
&END
&D MACH=   .00,ALTP=  2000.,ETAR= .9320,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .406308D+03,SPEC(1,9)=  .180104D+01,SPEC(1,8)=  .249952D+01,
SPEC(4,7)=  .339242D+04,SPEC(9,6)=  .360966D-02,SPEC(13,5)=  .599105D+01,
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SPEC(1,5)=  .147318D+01,SPEC(1,3)=  .549461D+00,SPEC(1,2)=  .133689D+01,
SPEC(14,1)=  .650000D+03,SPEC(1,16)=  .100998D+01,SPEC(1,17)=  .101043D+01,
SPEC(1,22)=  .102190D+01,SPEC(5,34)=  .200000D+02,SPEC(8,13)=  .113650D+01,
&END
&D MACH=   .20,ALTP=  2000.,ETAR= .9650,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .406108D+03,SPEC(1,9)=  .180114D+01,SPEC(1,8)=  .249928D+01,
SPEC(4,7)=  .341585D+04,SPEC(9,6)=  .340376D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .147307D+01,SPEC(1,3)=  .549508D+00,SPEC(1,2)=  .133689D+01,
SPEC(14,1)=  .650000D+03,SPEC(1,16)=  .101391D+01,SPEC(1,17)=  .101446D+01,
SPEC(1,22)=  .102190D+01,SPEC(5,34)=  .200000D+02,SPEC(8,13)=  .116384D+01,
&END
&D MACH=   .30,ALTP=  2000.,ETAR= .9706,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .406080D+03,SPEC(1,9)=  .180119D+01,SPEC(1,8)=  .249894D+01,
SPEC(4,7)=  .344578D+04,SPEC(9,6)=  .328533D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .147299D+01,SPEC(1,3)=  .549615D+00,SPEC(1,2)=  .133689D+01,
SPEC(14,1)=  .650000D+03,SPEC(1,16)=  .101878D+01,SPEC(1,17)=  .101949D+01,
SPEC(1,22)=  .102190D+01,SPEC(5,34)=  .200000D+02,SPEC(8,13)=  .118267D+01,
&END
&D MACH=   .40,ALTP=  2000.,ETAR= .9706,MODE= 1,NVOPT=  0,IWT= 1,INST= 0,
SPEC(2,11)=  .406036D+03,SPEC(1,9)=  .180126D+01,SPEC(1,8)=  .249846D+01,
SPEC(4,7)=  .348767D+04,SPEC(9,6)=  .315338D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .147289D+01,SPEC(1,3)=  .549752D+00,SPEC(1,2)=  .133689D+01,
SPEC(14,1)=  .650000D+03,SPEC(1,16)=  .102556D+01,SPEC(1,17)=  .102647D+01,
SPEC(1,22)=  .102190D+01,SPEC(5,34)=  .200000D+02,SPEC(8,13)=  .120617D+01,
&END
&D MACH=   .40,ALTP=  2000.,ETAR= .9706,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .344938D+03,SPEC(1,9)=  .183707D+01,SPEC(1,8)=  .251129D+01,
SPEC(4,7)=  .341251D+04,SPEC(9,6)=  .319706D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .148487D+01,SPEC(1,3)=  .568394D+00,SPEC(1,2)=  .134500D+01,
SPEC(14,1)=  .648830D+03,SPEC(1,16)=  .102055D+01,SPEC(1,17)=  .102400D+01,
SPEC(1,22)=  .107175D+01,SPEC(5,34)=  .206458D+02,SPEC(8,13)=  .118350D+01,
&END
&D MACH=   .40,ALTP=  2000.,ETAR= .9706,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .274352D+03,SPEC(1,9)=  .195278D+01,SPEC(1,8)=  .254148D+01,
SPEC(4,7)=  .319611D+04,SPEC(9,6)=  .332891D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .150618D+01,SPEC(1,3)=  .616179D+00,SPEC(1,2)=  .134562D+01,
SPEC(14,1)=  .642119D+03,SPEC(1,16)=  .100443D+01,SPEC(1,17)=  .101189D+01,
SPEC(1,22)=  .124288D+01,SPEC(5,34)=  .209333D+02,SPEC(8,13)=  .112304D+01,
&END
&D MACH=   .40,ALTP=  2000.,ETAR= .9706,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .280613D+03,SPEC(1,9)=  .200803D+01,SPEC(1,8)=  .255811D+01,
SPEC(4,7)=  .303158D+04,SPEC(9,6)=  .356555D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .151230D+01,SPEC(1,3)=  .683995D+00,SPEC(1,2)=  .138407D+01,
SPEC(14,1)=  .624656D+03,SPEC(1,16)=  .986653D+00,SPEC(1,17)=  .981575D+00,
SPEC(1,22)=  .134252D+01,SPEC(5,34)=  .245711D+02,SPEC(8,13)=  .107801D+01,
&END
&D MACH=   .40,ALTP=  2000.,ETAR= .9706,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .306468D+03,SPEC(1,9)=  .198051D+01,SPEC(1,8)=  .256251D+01,
SPEC(4,7)=  .290924D+04,SPEC(9,6)=  .391992D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .151337D+01,SPEC(1,3)=  .753037D+00,SPEC(1,2)=  .143391D+01,
SPEC(14,1)=  .591489D+03,SPEC(1,16)=  .968270D+00,SPEC(1,17)=  .927678D+00,
SPEC(1,22)=  .134186D+01,SPEC(5,34)=  .301698D+02,SPEC(8,13)=  .104802D+01,
&END
&D MACH=   .40,ALTP=  2000.,ETAR= .9706,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .321771D+03,SPEC(1,9)=  .193002D+01,SPEC(1,8)=  .256591D+01,
SPEC(4,7)=  .278813D+04,SPEC(9,6)=  .429614D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .151370D+01,SPEC(1,3)=  .793515D+00,SPEC(1,2)=  .142836D+01,
SPEC(14,1)=  .552145D+03,SPEC(1,16)=  .950268D+00,SPEC(1,17)=  .864465D+00,
SPEC(1,22)=  .132832D+01,SPEC(5,34)=  .325362D+02,SPEC(8,13)=  .102744D+01,
&END
&D MACH=   .40,ALTP=  2000.,ETAR= .9706,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .354482D+03,SPEC(1,9)=  .180937D+01,SPEC(1,8)=  .255436D+01,
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SPEC(4,7)=  .268880D+04,SPEC(9,6)=  .478522D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .150929D+01,SPEC(1,3)=  .821067D+00,SPEC(1,2)=  .140201D+01,
SPEC(14,1)=  .503336D+03,SPEC(1,16)=  .930376D+00,SPEC(1,17)=  .787426D+00,
SPEC(1,22)=  .123272D+01,SPEC(5,34)=  .349648D+02,SPEC(8,13)=  .101632D+01,
&END
&D MACH=   .40,ALTP=  2000.,ETAR= .9706,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .410211D+03,SPEC(1,9)=  .171576D+01,SPEC(1,8)=  .252739D+01,
SPEC(4,7)=  .259767D+04,SPEC(9,6)=  .535388D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .149917D+01,SPEC(1,3)=  .882989D+00,SPEC(1,2)=  .139958D+01,
SPEC(14,1)=  .465174D+03,SPEC(1,16)=  .909167D+00,SPEC(1,17)=  .726593D+00,
SPEC(1,22)=  .115988D+01,SPEC(5,34)=  .390236D+02,SPEC(8,13)=  .100688D+01,
&END
&D MACH=   .40,ALTP=  2000.,ETAR= .9706,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .454192D+03,SPEC(1,9)=  .163810D+01,SPEC(1,8)=  .249273D+01,
SPEC(4,7)=  .250194D+04,SPEC(9,6)=  .594720D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .148775D+01,SPEC(1,3)=  .921324D+00,SPEC(1,2)=  .136026D+01,
SPEC(14,1)=  .427282D+03,SPEC(1,16)=  .887610D+00,SPEC(1,17)=  .673374D+00,
SPEC(1,22)=  .111474D+01,SPEC(5,34)=  .385548D+02,SPEC(8,13)=  .100153D+01,
&END
&D MACH=   .60,ALTP=  2000.,ETAR= .9706,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .405975D+03,SPEC(1,9)=  .180145D+01,SPEC(1,8)=  .249847D+01,
SPEC(4,7)=  .349657D+04,SPEC(9,6)=  .276424D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .147274D+01,SPEC(1,3)=  .549672D+00,SPEC(1,2)=  .133689D+01,
SPEC(14,1)=  .650000D+03,SPEC(1,16)=  .102733D+01,SPEC(1,17)=  .102826D+01,
SPEC(1,22)=  .102190D+01,SPEC(5,34)=  .200000D+02,SPEC(8,13)=  .127682D+01,
SPEC(5,13)=0.981,SPEC(12,1)=0,
&END
&D MACH=   .40,ALTP= 10000.,ETAR= .9706,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .367248D+03,SPEC(1,9)=  .181929D+01,SPEC(1,8)=  .250841D+01,
SPEC(4,7)=  .318158D+04,SPEC(9,6)=  .408499D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .148025D+01,SPEC(1,3)=  .554700D+00,SPEC(1,2)=  .133689D+01,
SPEC(14,1)=  .650000D+03,SPEC(1,16)=  .978919D+00,SPEC(1,17)=  .980374D+00,
SPEC(1,22)=  .104740D+01,SPEC(8,13)=  .119384D+01,SPEC(5,34)=  .200000D+02,
SPEC(5,13)=0.950,
&END
&D MACH=   .60,ALTP= 10000.,ETAR= .9706,MODE= 1,NVOPT=  0,IWT= 1,INST= 0,
SPEC(2,11)=  .367181D+03,SPEC(1,9)=  .181959D+01,SPEC(1,8)=  .250711D+01,
SPEC(4,7)=  .329152D+04,SPEC(9,6)=  .364468D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .147991D+01,SPEC(1,3)=  .555080D+00,SPEC(1,2)=  .133689D+01,
SPEC(14,1)=  .650000D+03,SPEC(1,16)=  .997281D+00,SPEC(1,17)=  .999214D+00,
SPEC(1,22)=  .104740D+01,SPEC(8,13)=  .126359D+01,SPEC(5,34)=  .200000D+02,
SPEC(5,13)=0.981,
&END
&D MACH=   .60,ALTP= 10000.,ETAR= .9706,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .321116D+03,SPEC(1,9)=  .185764D+01,SPEC(1,8)=  .251952D+01,
SPEC(4,7)=  .321914D+04,SPEC(9,6)=  .369243D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .149084D+01,SPEC(1,3)=  .572492D+00,SPEC(1,2)=  .134181D+01,
SPEC(14,1)=  .648778D+03,SPEC(1,16)=  .992326D+00,SPEC(1,17)=  .996823D+00,
SPEC(1,22)=  .110096D+01,SPEC(5,34)=  .204102D+02,SPEC(8,13)=  .123816D+01,
&END
&D MACH=   .60,ALTP= 10000.,ETAR= .9706,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .269738D+03,SPEC(1,9)=  .196341D+01,SPEC(1,8)=  .254657D+01,
SPEC(4,7)=  .301690D+04,SPEC(9,6)=  .385479D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .150814D+01,SPEC(1,3)=  .617108D+00,SPEC(1,2)=  .133736D+01,
SPEC(14,1)=  .639085D+03,SPEC(1,16)=  .975811D+00,SPEC(1,17)=  .980293D+00,
SPEC(1,22)=  .126465D+01,SPEC(5,34)=  .204446D+02,SPEC(8,13)=  .117214D+01,
&END
&D MACH=   .60,ALTP= 10000.,ETAR= .9706,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .282407D+03,SPEC(1,9)=  .200223D+01,SPEC(1,8)=  .256061D+01,
SPEC(4,7)=  .286980D+04,SPEC(9,6)=  .415764D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .151281D+01,SPEC(1,3)=  .688997D+00,SPEC(1,2)=  .138478D+01,
SPEC(14,1)=  .618874D+03,SPEC(1,16)=  .958243D+00,SPEC(1,17)=  .946597D+00,
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SPEC(1,22)=  .134253D+01,SPEC(5,34)=  .249350D+02,SPEC(8,13)=  .112120D+01,
&END
&D MACH=   .60,ALTP= 10000.,ETAR= .9706,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .307317D+03,SPEC(1,9)=  .197404D+01,SPEC(1,8)=  .256527D+01,
SPEC(4,7)=  .275349D+04,SPEC(9,6)=  .457068D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .151372D+01,SPEC(1,3)=  .756180D+00,SPEC(1,2)=  .142915D+01,
SPEC(14,1)=  .585344D+03,SPEC(1,16)=  .940372D+00,SPEC(1,17)=  .893540D+00,
SPEC(1,22)=  .134239D+01,SPEC(5,34)=  .302700D+02,SPEC(8,13)=  .108490D+01,
&END
&D MACH=   .60,ALTP= 10000.,ETAR= .9706,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .326760D+03,SPEC(1,9)=  .187463D+01,SPEC(1,8)=  .256252D+01,
SPEC(4,7)=  .264677D+04,SPEC(9,6)=  .505230D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .151206D+01,SPEC(1,3)=  .777613D+00,SPEC(1,2)=  .140459D+01,
SPEC(14,1)=  .536003D+03,SPEC(1,16)=  .921616D+00,SPEC(1,17)=  .818473D+00,
SPEC(1,22)=  .127510D+01,SPEC(5,34)=  .320768D+02,SPEC(8,13)=  .106351D+01,
&END
&D MACH=   .60,ALTP= 10000.,ETAR= .9706,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .369637D+03,SPEC(1,9)=  .177632D+01,SPEC(1,8)=  .254734D+01,
SPEC(4,7)=  .255439D+04,SPEC(9,6)=  .563708D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .150611D+01,SPEC(1,3)=  .826831D+00,SPEC(1,2)=  .139743D+01,
SPEC(14,1)=  .493709D+03,SPEC(1,16)=  .902011D+00,SPEC(1,17)=  .751786D+00,
SPEC(1,22)=  .119902D+01,SPEC(5,34)=  .356018D+02,SPEC(8,13)=  .104460D+01,
&END
&D MACH=   .60,ALTP= 10000.,ETAR= .9706,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .408971D+03,SPEC(1,9)=  .171141D+01,SPEC(1,8)=  .252866D+01,
SPEC(4,7)=  .245645D+04,SPEC(9,6)=  .623945D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .149862D+01,SPEC(1,3)=  .886640D+00,SPEC(1,2)=  .139234D+01,
SPEC(14,1)=  .460641D+03,SPEC(1,16)=  .882417D+00,SPEC(1,17)=  .701372D+00,
SPEC(1,22)=  .116438D+01,SPEC(5,34)=  .387870D+02,SPEC(8,13)=  .102743D+01,
&END
&D MACH=   .60,ALTP= 10000.,ETAR= .9706,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .470017D+03,SPEC(1,9)=  .162270D+01,SPEC(1,8)=  .248466D+01,
SPEC(4,7)=  .237295D+04,SPEC(9,6)=  .698394D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .148451D+01,SPEC(1,3)=  .933104D+00,SPEC(1,2)=  .135692D+01,
SPEC(14,1)=  .421672D+03,SPEC(1,16)=  .860227D+00,SPEC(1,17)=  .647503D+00,
SPEC(1,22)=  .110318D+01,SPEC(5,34)=  .387488D+02,SPEC(8,13)=  .101609D+01,
&END
&D MACH=   .90,ALTP= 10000.,ETAR= .9706,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .367075D+03,SPEC(1,9)=  .182002D+01,SPEC(1,8)=  .250426D+01,
SPEC(4,7)=  .353536D+04,SPEC(9,6)=  .286148D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .147923D+01,SPEC(1,3)=  .555866D+00,SPEC(1,2)=  .133689D+01,
SPEC(14,1)=  .650000D+03,SPEC(1,16)=  .103712D+01,SPEC(1,17)=  .104033D+01,
SPEC(1,22)=  .104740D+01,SPEC(8,13)=  .148711D+01,SPEC(5,34)=  .200000D+02,
SPEC(6,13)=3,
&END
&D MACH=   .40,ALTP= 15000.,ETAR= .9706,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .367394D+03,SPEC(1,9)=  .181872D+01,SPEC(1,8)=  .250954D+01,
SPEC(4,7)=  .307811D+04,SPEC(9,6)=  .488390D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .148060D+01,SPEC(1,3)=  .554553D+00,SPEC(1,2)=  .133689D+01,
SPEC(14,1)=  .650000D+03,SPEC(1,16)=  .961003D+00,SPEC(1,17)=  .962135D+00,
SPEC(1,22)=  .104740D+01,SPEC(8,13)=  .119296D+01,SPEC(5,34)=  .200000D+02,
SPEC(5,13)=0.950,SPEC(6,13)=1,
&END
&D MACH=   .60,ALTP= 15000.,ETAR= .9706,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .367378D+03,SPEC(1,9)=  .181916D+01,SPEC(1,8)=  .250829D+01,
SPEC(4,7)=  .318443D+04,SPEC(9,6)=  .435775D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .148032D+01,SPEC(1,3)=  .554801D+00,SPEC(1,2)=  .133689D+01,
SPEC(14,1)=  .650000D+03,SPEC(1,16)=  .979149D+00,SPEC(1,17)=  .980631D+00,
SPEC(1,22)=  .104740D+01,SPEC(8,13)=  .126242D+01,SPEC(5,34)=  .200000D+02,
SPEC(5,13)=0.981,
&END
&D MACH=   .90,ALTP= 15000.,ETAR= .9706,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
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SPEC(2,11)=  .406183D+03,SPEC(1,9)=  .180109D+01,SPEC(1,8)=  .249876D+01,
SPEC(4,7)=  .345566D+04,SPEC(9,6)=  .340854D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .147305D+01,SPEC(1,3)=  .549683D+00,SPEC(1,2)=  .133689D+01,
SPEC(14,1)=  .650000D+03,SPEC(1,16)=  .102024D+01,SPEC(1,17)=  .102100D+01,
SPEC(1,22)=  .102184D+01,SPEC(8,13)=  .149801D+01,SPEC(5,34)=  .200000D+02,
SPEC(6,13)=3,
&END
&D MACH=   .40,ALTP= 20000.,ETAR= .9706,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .372230D+03,SPEC(1,9)=  .181537D+01,SPEC(1,8)=  .250968D+01,
SPEC(4,7)=  .297914D+04,SPEC(9,6)=  .587709D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .147994D+01,SPEC(1,3)=  .553882D+00,SPEC(1,2)=  .133689D+01,
SPEC(14,1)=  .650000D+03,SPEC(1,16)=  .942813D+00,SPEC(1,17)=  .943552D+00,
SPEC(1,22)=  .104387D+01,SPEC(8,13)=  .119356D+01,SPEC(5,34)=  .200000D+02,
SPEC(5,13)=0.950,SPEC(6,13)=1,
&END
&D MACH=   .60,ALTP= 20000.,ETAR= .9706,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .371998D+03,SPEC(1,9)=  .181597D+01,SPEC(1,8)=  .250854D+01,
SPEC(4,7)=  .308148D+04,SPEC(9,6)=  .524331D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .147985D+01,SPEC(1,3)=  .553845D+00,SPEC(1,2)=  .133689D+01,
SPEC(14,1)=  .650000D+03,SPEC(1,16)=  .960773D+00,SPEC(1,17)=  .961696D+00,
SPEC(1,22)=  .104387D+01,SPEC(8,13)=  .126301D+01,SPEC(5,34)=  .200000D+02,
SPEC(5,13)=0.981,
&END
&D MACH=   .90,ALTP= 20000.,ETAR= .9706,MODE= 1,NVOPT=  0,IWT= 1,INST= 0,
SPEC(2,11)=  .406410D+03,SPEC(1,9)=  .180074D+01,SPEC(1,8)=  .250002D+01,
SPEC(4,7)=  .333984D+04,SPEC(9,6)=  .410391D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .147340D+01,SPEC(1,3)=  .549367D+00,SPEC(1,2)=  .133689D+01,
SPEC(14,1)=  .650000D+03,SPEC(1,16)=  .100110D+01,SPEC(1,17)=  .100130D+01,
SPEC(1,22)=  .102184D+01,SPEC(8,13)=  .149885D+01,SPEC(5,34)=  .200000D+02,
SPEC(6,13)=3,
&END
&D MACH=  1.10,ALTP= 20000.,ETAR= .9664,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .350988D+03,SPEC(1,9)=  .183356D+01,SPEC(1,8)=  .250807D+01,
SPEC(4,7)=  .350480D+04,SPEC(9,6)=  .337753D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .148163D+01,SPEC(1,3)=  .558212D+00,SPEC(1,2)=  .133819D+01,
SPEC(14,1)=  .653000D+03,SPEC(1,16)=  .103329D+01,SPEC(1,17)=  .104096D+01,
SPEC(1,22)=  .106136D+01,SPEC(8,13)=  .184830D+01,SPEC(5,34)=  .200000D+02,
/* SPEC(4,12)=2235, */
&END
/* &D SPEC(4,12)=0, &END */
&D MACH=   .90,ALTP= 30000.,ETAR= .9706,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .372298D+03,SPEC(1,9)=  .181553D+01,SPEC(1,8)=  .250829D+01,
SPEC(4,7)=  .307985D+04,SPEC(9,6)=  .610658D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .148011D+01,SPEC(1,3)=  .554183D+00,SPEC(1,2)=  .133689D+01,
SPEC(14,1)=  .650000D+03,SPEC(1,16)=  .959711D+00,SPEC(1,17)=  .960701D+00,
SPEC(1,22)=  .104387D+01,SPEC(8,13)=  .147994D+01,SPEC(5,34)=  .200000D+02,
&END
&D MACH=   .90,ALTP= 30000.,ETAR= .9706,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .323826D+03,SPEC(1,9)=  .185059D+01,SPEC(1,8)=  .252034D+01,
SPEC(4,7)=  .301003D+04,SPEC(9,6)=  .618217D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .149120D+01,SPEC(1,3)=  .567676D+00,SPEC(1,2)=  .133576D+01,
SPEC(14,1)=  .647624D+03,SPEC(1,16)=  .954584D+00,SPEC(1,17)=  .956622D+00,
SPEC(1,22)=  .109606D+01,SPEC(5,34)=  .200000D+02,SPEC(8,13)=  .142475D+01,
&END
&D MACH=   .90,ALTP= 30000.,ETAR= .9706,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .270628D+03,SPEC(1,9)=  .195753D+01,SPEC(1,8)=  .254804D+01,
SPEC(4,7)=  .282089D+04,SPEC(9,6)=  .646109D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .150838D+01,SPEC(1,3)=  .614674D+00,SPEC(1,2)=  .133430D+01,
SPEC(14,1)=  .638244D+03,SPEC(1,16)=  .938623D+00,SPEC(1,17)=  .941328D+00,
SPEC(1,22)=  .126032D+01,SPEC(5,34)=  .202516D+02,SPEC(8,13)=  .135292D+01,
&END
&D MACH=   .90,ALTP= 30000.,ETAR= .9706,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
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SPEC(2,11)=  .287687D+03,SPEC(1,9)=  .198416D+01,SPEC(1,8)=  .256014D+01,
SPEC(4,7)=  .268927D+04,SPEC(9,6)=  .701062D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .151209D+01,SPEC(1,3)=  .692208D+00,SPEC(1,2)=  .139189D+01,
SPEC(14,1)=  .616462D+03,SPEC(1,16)=  .921162D+00,SPEC(1,17)=  .906320D+00,
SPEC(1,22)=  .132098D+01,SPEC(5,34)=  .256034D+02,SPEC(8,13)=  .127524D+01,
&END
&D MACH=   .90,ALTP= 30000.,ETAR= .9706,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .315657D+03,SPEC(1,9)=  .194758D+01,SPEC(1,8)=  .256387D+01,
SPEC(4,7)=  .258345D+04,SPEC(9,6)=  .773321D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .151250D+01,SPEC(1,3)=  .760852D+00,SPEC(1,2)=  .143852D+01,
SPEC(14,1)=  .581541D+03,SPEC(1,16)=  .903583D+00,SPEC(1,17)=  .852998D+00,
SPEC(1,22)=  .131048D+01,SPEC(5,34)=  .312209D+02,SPEC(8,13)=  .122173D+01,
&END
&D MACH=   .90,ALTP= 30000.,ETAR= .9706,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .321004D+03,SPEC(1,9)=  .192003D+01,SPEC(1,8)=  .257105D+01,
SPEC(4,7)=  .246580D+04,SPEC(9,6)=  .840553D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .151345D+01,SPEC(1,3)=  .795351D+00,SPEC(1,2)=  .141908D+01,
SPEC(14,1)=  .545498D+03,SPEC(1,16)=  .886906D+00,SPEC(1,17)=  .799844D+00,
SPEC(1,22)=  .133025D+01,SPEC(5,34)=  .323824D+02,SPEC(8,13)=  .117765D+01,
&END
&D MACH=   .90,ALTP= 30000.,ETAR= .9706,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .355968D+03,SPEC(1,9)=  .180661D+01,SPEC(1,8)=  .255965D+01,
SPEC(4,7)=  .237871D+04,SPEC(9,6)=  .937460D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .150875D+01,SPEC(1,3)=  .834127D+00,SPEC(1,2)=  .140299D+01,
SPEC(14,1)=  .499674D+03,SPEC(1,16)=  .868063D+00,SPEC(1,17)=  .731179D+00,
SPEC(1,22)=  .124118D+01,SPEC(5,34)=  .354552D+02,SPEC(8,13)=  .115049D+01,
&END
&D MACH=   .90,ALTP= 30000.,ETAR= .9706,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .404919D+03,SPEC(1,9)=  .171970D+01,SPEC(1,8)=  .253467D+01,
SPEC(4,7)=  .229566D+04,SPEC(9,6)=  .104702D-01,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .149938D+01,SPEC(1,3)=  .898943D+00,SPEC(1,2)=  .140146D+01,
SPEC(14,1)=  .463203D+03,SPEC(1,16)=  .848216D+00,SPEC(1,17)=  .676786D+00,
SPEC(1,22)=  .117806D+01,SPEC(5,34)=  .394725D+02,SPEC(8,13)=  .112405D+01,
&END
&D MACH=   .90,ALTP= 30000.,ETAR= .9706,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .447645D+03,SPEC(1,9)=  .163912D+01,SPEC(1,8)=  .249899D+01,
SPEC(4,7)=  .221237D+04,SPEC(9,6)=  .116571D-01,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .148857D+01,SPEC(1,3)=  .941851D+00,SPEC(1,2)=  .136283D+01,
SPEC(14,1)=  .425435D+03,SPEC(1,16)=  .827627D+00,SPEC(1,17)=  .626784D+00,
SPEC(1,22)=  .113016D+01,SPEC(5,34)=  .391850D+02,SPEC(8,13)=  .110017D+01,
&END
&D MACH=  1.10,ALTP= 30000.,ETAR= .9664,MODE= 1,NVOPT=  0,IWT= 1,INST= 0,
SPEC(2,11)=  .371478D+03,SPEC(1,9)=  .181992D+01,SPEC(1,8)=  .250641D+01,
SPEC(4,7)=  .328246D+04,SPEC(9,6)=  .499674D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .147853D+01,SPEC(1,3)=  .553523D+00,SPEC(1,2)=  .133819D+01,
SPEC(14,1)=  .653000D+03,SPEC(1,16)=  .993719D+00,SPEC(1,17)=  .998785D+00,
SPEC(1,22)=  .104387D+01,SPEC(8,13)=  .185185D+01,SPEC(5,34)=  .200000D+02,
/* SPEC(4,12)=2120, */
&END
/* &D SPEC(4,12)=0, &END */
&D MACH=  1.40,ALTP= 30000.,ETAR= .9348,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .373995D+03,SPEC(1,9)=  .180328D+01,SPEC(1,8)=  .250141D+01,
SPEC(4,7)=  .354927D+04,SPEC(9,6)=  .377404D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .148204D+01,SPEC(1,3)=  .559785D+00,SPEC(1,2)=  .133024D+01,
SPEC(14,1)=  .637000D+03,SPEC(1,16)=  .103967D+01,SPEC(1,17)=  .102843D+01,
SPEC(1,22)=  .104387D+01,SPEC(8,13)=  .227334D+01,SPEC(5,34)=  .200000D+02,
&END
&D MACH=  1.50,ALTP= 30000.,ETAR= .8893,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .407504D+03,SPEC(1,9)=  .177797D+01,SPEC(1,8)=  .249384D+01,
SPEC(4,7)=  .365879D+04,SPEC(9,6)=  .357336D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .147967D+01,SPEC(1,3)=  .558119D+00,SPEC(1,2)=  .132442D+01,
SPEC(14,1)=  .625000D+03,SPEC(1,16)=  .105547D+01,SPEC(1,17)=  .103013D+01,
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SPEC(1,22)= .102300D+01,SPEC(8,13)= .241798D+01,SPEC(5,34)= .200000D+02,
&END
&D MACH= 1.53,ALTP= 30000.,ETAR= .9320,MODE= 1,NVOPT= 0,IWT= 0,INST= 0,
SPEC(2,11)= .408935D+03,SPEC(1,9)= .177495D+01,SPEC(1,8)= .249345D+01,
SPEC(4,7)= .368289D+04,SPEC(9,6)= .330733D-02,SPEC(13,5)= .599105D+01,
SPEC(1,5)= .148024D+01,SPEC(1,3)= .558839D+00,SPEC(1,2)= .132278D+01,
SPEC(14,1)= .621000D+03,SPEC(1,16)= .105998D+01,SPEC(1,17)= .103037D+01,
SPEC(1,22)= .102300D+01,SPEC(8,13)= .253130D+01,SPEC(5,34)= .200000D+02,
&END
&D MACH= 1.60,ALTP= 30000.,ETAR= .9320,MODE= 1,NVOPT= 0,IWT= 0,INST= 0,
SPEC(2,11)= .409479D+03,SPEC(1,9)= .176891D+01,SPEC(1,8)= .249243D+01,
SPEC(4,7)= .374827D+04,SPEC(9,6)= .307089D-02,SPEC(13,5)= .599105D+01,
SPEC(1,5)= .148133D+01,SPEC(1,3)= .560312D+00,SPEC(1,2)= .131973D+01,
SPEC(14,1)= .613000D+03,SPEC(1,16)= .107143D+01,SPEC(1,17)= .103317D+01,
SPEC(1,22)= .102300D+01,SPEC(8,13)= .267929D+01,SPEC(5,34)= .200000D+02,
&END
&D MACH=  .90,ALTP= 36089.,ETAR= .9706,MODE= 1,NVOPT= 0,IWT= 0,INST= 0,
SPEC(2,11)= .395556D+03,SPEC(1,9)= .180307D+01,SPEC(1,8)= .250552D+01,
SPEC(4,7)= .295797D+04,SPEC(9,6)= .787986D-02,SPEC(13,5)= .599105D+01,
SPEC(1,5)= .147651D+01,SPEC(1,3)= .551122D+00,SPEC(1,2)= .133687D+01,
SPEC(14,1)= .650000D+03,SPEC(1,16)= .935276D+00,SPEC(1,17)= .935108D+00,
SPEC(1,22)= .102863D+01,SPEC(8,13)= .148637D+01,SPEC(5,34)= .200000D+02,
&END
&D MACH= 1.10,ALTP= 36089.,ETAR= .9664,MODE= 1,NVOPT= 0,IWT= 0,INST= 0,
SPEC(2,11)= .394250D+03,SPEC(1,9)= .180792D+01,SPEC(1,8)= .250393D+01,
SPEC(4,7)= .315093D+04,SPEC(9,6)= .644590D-02,SPEC(13,5)= .599105D+01,
SPEC(1,5)= .147505D+01,SPEC(1,3)= .549748D+00,SPEC(1,2)= .133819D+01,
SPEC(14,1)= .653000D+03,SPEC(1,16)= .968780D+00,SPEC(1,17)= .972211D+00,
SPEC(1,22)= .102863D+01,SPEC(8,13)= .186075D+01,SPEC(5,34)= .200000D+02,
/* SPEC(4,12)=2050, */
&END
/* &D SPEC(4,12)=0, &END */
&D MACH= 1.10,ALTP= 36089.,ETAR= .9664,MODE= 1,NVOPT= 0,IWT= 0,INST= 0,
SPEC(2,11)= .348820D+03,SPEC(1,9)= .183397D+01,SPEC(1,8)= .251398D+01,
SPEC(4,7)= .308470D+04,SPEC(9,6)= .655212D-02,SPEC(13,5)= .599105D+01,
SPEC(1,5)= .148551D+01,SPEC(1,3)= .567643D+00,SPEC(1,2)= .134644D+01,
SPEC(14,1)= .649839D+03,SPEC(1,16)= .963229D+00,SPEC(1,17)= .966233D+00,
SPEC(1,22)= .106844D+01,SPEC(5,34)= .207213D+02,SPEC(8,13)= .182670D+01,
&END
&D MACH= 1.10,ALTP= 36089.,ETAR= .9664,MODE= 1,NVOPT= 0,IWT= 0,INST= 0,
SPEC(2,11)= .266586D+03,SPEC(1,9)= .199084D+01,SPEC(1,8)= .255143D+01,
SPEC(4,7)= .287909D+04,SPEC(9,6)= .677086D-02,SPEC(13,5)= .599105D+01,
SPEC(1,5)= .150975D+01,SPEC(1,3)= .618970D+00,SPEC(1,2)= .134285D+01,
SPEC(14,1)= .649438D+03,SPEC(1,16)= .949437D+00,SPEC(1,17)= .965641D+00,
SPEC(1,22)= .128675D+01,SPEC(5,34)= .204655D+02,SPEC(8,13)= .166597D+01,
&END
&D MACH= 1.10,ALTP= 36089.,ETAR= .9664,MODE= 1,NVOPT= 0,IWT= 0,INST= 0,
SPEC(2,11)= .300575D+03,SPEC(1,9)= .198718D+01,SPEC(1,8)= .255745D+01,
SPEC(4,7)= .275674D+04,SPEC(9,6)= .742955D-02,SPEC(13,5)= .599105D+01,
SPEC(1,5)= .151161D+01,SPEC(1,3)= .711878D+00,SPEC(1,2)= .143556D+01,
SPEC(14,1)= .625822D+03,SPEC(1,16)= .930299D+00,SPEC(1,17)= .925430D+00,
SPEC(1,22)= .130429D+01,SPEC(5,34)= .281373D+02,SPEC(8,13)= .158116D+01,
&END
&D MACH= 1.10,ALTP= 36089.,ETAR= .9664,MODE= 1,NVOPT= 0,IWT= 0,INST= 0,
SPEC(2,11)= .327124D+03,SPEC(1,9)= .194716D+01,SPEC(1,8)= .256054D+01,
SPEC(4,7)= .264585D+04,SPEC(9,6)= .818297D-02,SPEC(13,5)= .599105D+01,
SPEC(1,5)= .151197D+01,SPEC(1,3)= .775778D+00,SPEC(1,2)= .147936D+01,
SPEC(14,1)= .589412D+03,SPEC(1,16)= .912123D+00,SPEC(1,17)= .869460D+00,
SPEC(1,22)= .129281D+01,SPEC(5,34)= .333702D+02,SPEC(8,13)= .151187D+01,
&END
&D MACH= 1.10,ALTP= 36089.,ETAR= .9664,MODE= 1,NVOPT= 0,IWT= 0,INST= 0,
SPEC(2,11)= .345993D+03,SPEC(1,9)= .190842D+01,SPEC(1,8)= .256619D+01,
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Listing of "*supersonic.input*" (Continued)

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SPEC(4,7)=  .253521D+04,SPEC(9,6)=  .897063D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .151282D+01,SPEC(1,3)=  .828520D+00,SPEC(1,2)=  .148232D+01,
SPEC(14,1)=  .553631D+03,SPEC(1,16)=  .895128D+00,SPEC(1,17)=  .812916D+00,
SPEC(1,22)=  .129074D+01,SPEC(5,34)=  .366807D+02,SPEC(8,13)=  .145106D+01,
&END
&D MACH=  1.10,ALTP= 36089.,ETAR= .9664,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .355301D+03,SPEC(1,9)=  .187526D+01,SPEC(1,8)=  .257227D+01,
SPEC(4,7)=  .242128D+04,SPEC(9,6)=  .976388D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .151331D+01,SPEC(1,3)=  .871572D+00,SPEC(1,2)=  .146510D+01,
SPEC(14,1)=  .520651D+03,SPEC(1,16)=  .878510D+00,SPEC(1,17)=  .762186D+00,
SPEC(1,22)=  .130410D+01,SPEC(5,34)=  .386790D+02,SPEC(8,13)=  .139703D+01,
&END
&D MACH=  1.10,ALTP= 36089.,ETAR= .9664,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .365163D+03,SPEC(1,9)=  .180963D+01,SPEC(1,8)=  .256671D+01,
SPEC(4,7)=  .231543D+04,SPEC(9,6)=  .106743D-01,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .151039D+01,SPEC(1,3)=  .900005D+00,SPEC(1,2)=  .141940D+01,
SPEC(14,1)=  .483455D+03,SPEC(1,16)=  .860507D+00,SPEC(1,17)=  .709033D+00,
SPEC(1,22)=  .128429D+01,SPEC(5,34)=  .388528D+02,SPEC(8,13)=  .135856D+01,
&END
&D MACH=  1.10,ALTP= 36089.,ETAR= .9664,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .369080D+03,SPEC(1,9)=  .176210D+01,SPEC(1,8)=  .255752D+01,
SPEC(4,7)=  .221247D+04,SPEC(9,6)=  .116403D-01,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .150835D+01,SPEC(1,3)=  .932993D+00,SPEC(1,2)=  .137995D+01,
SPEC(14,1)=  .451031D+03,SPEC(1,16)=  .842608D+00,SPEC(1,17)=  .666213D+00,
SPEC(1,22)=  .128720D+01,SPEC(5,34)=  .384435D+02,SPEC(8,13)=  .131804D+01,
&END
&D MACH=  1.40,ALTP= 36089.,ETAR= .9348,MODE= 1,NVOPT=  0,IWT= 1,INST= 0,
SPEC(2,11)=  .397201D+03,SPEC(1,9)=  .179178D+01,SPEC(1,8)=  .249893D+01,
SPEC(4,7)=  .340790D+04,SPEC(9,6)=  .486952D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .147922D+01,SPEC(1,3)=  .556036D+00,SPEC(1,2)=  .133024D+01,
SPEC(14,1)=  .637000D+03,SPEC(1,16)=  .101385D+01,SPEC(1,17)=  .100110D+01,
SPEC(1,22)=  .102863D+01,SPEC(8,13)=  .228372D+01,SPEC(5,34)=  .200000D+02,
&END
&D MACH=  1.50,ALTP= 36089.,ETAR= .8893,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .399732D+03,SPEC(1,9)=  .178128D+01,SPEC(1,8)=  .249703D+01,
SPEC(4,7)=  .348551D+04,SPEC(9,6)=  .462516D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .148134D+01,SPEC(1,3)=  .559566D+00,SPEC(1,2)=  .132443D+01,
SPEC(14,1)=  .625000D+03,SPEC(1,16)=  .102778D+01,SPEC(1,17)=  .100278D+01,
SPEC(1,22)=  .102863D+01,SPEC(8,13)=  .240129D+01,SPEC(5,34)=  .200000D+02,
&END
&D MACH=  1.53,ALTP= 36089.,ETAR= .9320,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .400109D+03,SPEC(1,9)=  .177825D+01,SPEC(1,8)=  .249666D+01,
SPEC(4,7)=  .350845D+04,SPEC(9,6)=  .428084D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .148190D+01,SPEC(1,3)=  .560401D+00,SPEC(1,2)=  .132278D+01,
SPEC(14,1)=  .621000D+03,SPEC(1,16)=  .103218D+01,SPEC(1,17)=  .100302D+01,
SPEC(1,22)=  .102863D+01,SPEC(8,13)=  .251445D+01,SPEC(5,34)=  .200000D+02,
&END
&D MACH=  1.60,ALTP= 36089.,ETAR= .9320,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .400410D+03,SPEC(1,9)=  .177211D+01,SPEC(1,8)=  .249561D+01,
SPEC(4,7)=  .357122D+04,SPEC(9,6)=  .397465D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .148279D+01,SPEC(1,3)=  .562096D+00,SPEC(1,2)=  .131973D+01,
SPEC(14,1)=  .613000D+03,SPEC(1,16)=  .104333D+01,SPEC(1,17)=  .100576D+01,
SPEC(1,22)=  .102863D+01,SPEC(8,13)=  .265775D+01,SPEC(5,34)=  .200000D+02,
&END
&D MACH=  1.80,ALTP= 36089.,ETAR= .9320,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .385930D+03,SPEC(1,9)=  .176167D+01,SPEC(1,8)=  .249553D+01,
SPEC(4,7)=  .374806D+04,SPEC(9,6)=  .320539D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .148668D+01,SPEC(1,3)=  .569271D+00,SPEC(1,2)=  .131091D+01,
SPEC(14,1)=  .590000D+03,SPEC(1,16)=  .107636D+01,SPEC(1,17)=  .101402D+01,
SPEC(1,22)=  .103881D+01,SPEC(8,13)=  .319822D+01,SPEC(5,34)=  .200000D+02,
&END
&D MACH=   .90,ALTP= 40000.,ETAR= .9706,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
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SPEC(2,11)= .396428D+03,SPEC(1,9)= .180225D+01,SPEC(1,8)= .250488D+01,
SPEC(4,7)= .296412D+04,SPEC(9,6)= .950482D-02,SPEC(13,5)= .599105D+01,
SPEC(1,5)= .147691D+01,SPEC(1,3)= .551764D+00,SPEC(1,2)= .133689D+01,
SPEC(14,1)= .650000D+03,SPEC(1,16)= .934824D+00,SPEC(1,17)= .934861D+00,
SPEC(1,22)= .102863D+01,SPEC(8,13)= .148542D+01,SPEC(5,34)= .200000D+02,
&END
&D MACH= 1.10,ALTP= 40000.,ETAR= .9664,MODE= 1,NVOPT= 0,IWT= 0,INST= 0,
SPEC(2,11)= .394500D+03,SPEC(1,9)= .180719D+01,SPEC(1,8)= .250344D+01,
SPEC(4,7)= .315591D+04,SPEC(9,6)= .777408D-02,SPEC(13,5)= .599105D+01,
SPEC(1,5)= .147543D+01,SPEC(1,3)= .550260D+00,SPEC(1,2)= .133819D+01,
SPEC(14,1)= .653000D+03,SPEC(1,16)= .968389D+00,SPEC(1,17)= .971933D+00,
SPEC(1,22)= .102863D+01,SPEC(8,13)= .186116D+01,SPEC(5,34)= .200000D+02,
/* SPEC(4,12)=2050, */
&END
/* &D SPEC(4,12)=0, &END */
&D MACH= 1.40,ALTP= 40000.,ETAR= .9348,MODE= 1,NVOPT= 0,IWT= 0,INST= 0,
SPEC(2,11)= .397322D+03,SPEC(1,9)= .179131D+01,SPEC(1,8)= .249858D+01,
SPEC(4,7)= .341114D+04,SPEC(9,6)= .587213D-02,SPEC(13,5)= .599105D+01,
SPEC(1,5)= .147956D+01,SPEC(1,3)= .556356D+00,SPEC(1,2)= .133024D+01,
SPEC(14,1)= .637000D+03,SPEC(1,16)= .101346D+01,SPEC(1,17)= .100081D+01,
SPEC(1,22)= .102863D+01,SPEC(8,13)= .228183D+01,SPEC(5,34)= .200000D+02,
&END
&D MACH= 1.50,ALTP= 40000.,ETAR= .8893,MODE= 1,NVOPT= 0,IWT= 1,INST= 0,
SPEC(2,11)= .399200D+03,SPEC(1,9)= .178084D+01,SPEC(1,8)= .249669D+01,
SPEC(4,7)= .348856D+04,SPEC(9,6)= .557735D-02,SPEC(13,5)= .599105D+01,
SPEC(1,5)= .148163D+01,SPEC(1,3)= .559875D+00,SPEC(1,2)= .132443D+01,
SPEC(14,1)= .625000D+03,SPEC(1,16)= .102740D+01,SPEC(1,17)= .100250D+01,
SPEC(1,22)= .102863D+01,SPEC(8,13)= .240077D+01,SPEC(5,34)= .200000D+02,
&END
&D MACH= 1.50,ALTP= 40000.,ETAR= .8893,MODE= 1,NVOPT= 0,IWT= 0,INST= 0,
SPEC(2,11)= .342669D+03,SPEC(1,9)= .181811D+01,SPEC(1,8)= .251069D+01,
SPEC(4,7)= .341538D+04,SPEC(9,6)= .565832D-02,SPEC(13,5)= .599105D+01,
SPEC(1,5)= .149090D+01,SPEC(1,3)= .582301D+00,SPEC(1,2)= .133745D+01,
SPEC(14,1)= .624910D+03,SPEC(1,16)= .102280D+01,SPEC(1,17)= .100145D+01,
SPEC(1,22)= .108006D+01,SPEC(5,34)= .210000D+02,SPEC(8,13)= .233418D+01,
&END
&D MACH= 1.50,ALTP= 40000.,ETAR= .8893,MODE= 1,NVOPT= 0,IWT= 0,INST= 0,
SPEC(2,11)= .308784D+03,SPEC(1,9)= .191884D+01,SPEC(1,8)= .253844D+01,
SPEC(4,7)= .323412D+04,SPEC(9,6)= .602119D-02,SPEC(13,5)= .599105D+01,
SPEC(1,5)= .150581D+01,SPEC(1,3)= .674650D+00,SPEC(1,2)= .140847D+01,
SPEC(14,1)= .621522D+03,SPEC(1,16)= .100776D+01,SPEC(1,17)= .993090D+00,
SPEC(1,22)= .121600D+01,SPEC(5,34)= .265112D+02,SPEC(8,13)= .213759D+01,
&END
&D MACH= 1.50,ALTP= 40000.,ETAR= .8893,MODE= 1,NVOPT= 0,IWT= 0,INST= 0,
SPEC(2,11)= .310746D+03,SPEC(1,9)= .197869D+01,SPEC(1,8)= .255598D+01,
SPEC(4,7)= .307457D+04,SPEC(9,6)= .646736D-02,SPEC(13,5)= .599105D+01,
SPEC(1,5)= .151222D+01,SPEC(1,3)= .749778D+00,SPEC(1,2)= .145481D+01,
SPEC(14,1)= .604608D+03,SPEC(1,16)= .991139D+00,SPEC(1,17)= .964920D+00,
SPEC(1,22)= .131906D+01,SPEC(5,34)= .306515D+02,SPEC(8,13)= .198765D+01,
&END
&D MACH= 1.50,ALTP= 40000.,ETAR= .8893,MODE= 1,NVOPT= 0,IWT= 0,INST= 0,
SPEC(2,11)= .335284D+03,SPEC(1,9)= .192898D+01,SPEC(1,8)= .255893D+01,
SPEC(4,7)= .295363D+04,SPEC(9,6)= .712272D-02,SPEC(13,5)= .599105D+01,
SPEC(1,5)= .151282D+01,SPEC(1,3)= .806285D+00,SPEC(1,2)= .147306D+01,
SPEC(14,1)= .566715D+03,SPEC(1,16)= .972610D+00,SPEC(1,17)= .900795D+00,
SPEC(1,22)= .129956D+01,SPEC(5,34)= .348652D+02,SPEC(8,13)= .190595D+01,
&END
&D MACH= 1.50,ALTP= 40000.,ETAR= .8893,MODE= 1,NVOPT= 0,IWT= 0,INST= 0,
SPEC(2,11)= .340963D+03,SPEC(1,9)= .189940D+01,SPEC(1,8)= .256594D+01,
SPEC(4,7)= .282030D+04,SPEC(9,6)= .773536D-02,SPEC(13,5)= .599105D+01,
SPEC(1,5)= .151405D+01,SPEC(1,3)= .841839D+00,SPEC(1,2)= .145003D+01,
SPEC(14,1)= .532093D+03,SPEC(1,16)= .955022D+00,SPEC(1,17)= .844220D+00,
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SPEC(1,22)=  .131787D+01,SPEC(5,34)=  .364191D+02,SPEC(8,13)=  .183003D+01,
&END
&D MACH=  1.50,ALTP= 40000.,ETAR= .8893,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .358188D+03,SPEC(1,9)=  .184154D+01,SPEC(1,8)=  .256569D+01,
SPEC(4,7)=  .270269D+04,SPEC(9,6)=  .847541D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .151302D+01,SPEC(1,3)=  .887056D+00,SPEC(1,2)=  .143297D+01,
SPEC(14,1)=  .497556D+03,SPEC(1,16)=  .936698D+00,SPEC(1,17)=  .787265D+00,
SPEC(1,22)=  .129994D+01,SPEC(5,34)=  .384293D+02,SPEC(8,13)=  .176839D+01,
&END
&D MACH=  1.50,ALTP= 40000.,ETAR= .8893,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .362891D+03,SPEC(1,9)=  .179197D+01,SPEC(1,8)=  .255947D+01,
SPEC(4,7)=  .258216D+04,SPEC(9,6)=  .922673D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .151119D+01,SPEC(1,3)=  .917604D+00,SPEC(1,2)=  .139300D+01,
SPEC(14,1)=  .464441D+03,SPEC(1,16)=  .917829D+00,SPEC(1,17)=  .739170D+00,
SPEC(1,22)=  .129982D+01,SPEC(5,34)=  .383943D+02,SPEC(8,13)=  .171758D+01,
&END
&D MACH=  1.50,ALTP= 40000.,ETAR= .8893,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .373665D+03,SPEC(1,9)=  .174018D+01,SPEC(1,8)=  .254627D+01,
SPEC(4,7)=  .247476D+04,SPEC(9,6)=  .101083D-01,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .150981D+01,SPEC(1,3)=  .962331D+00,SPEC(1,2)=  .136587D+01,
SPEC(14,1)=  .433823D+03,SPEC(1,16)=  .898702D+00,SPEC(1,17)=  .694457D+00,
SPEC(1,22)=  .129269D+01,SPEC(5,34)=  .385788D+02,SPEC(8,13)=  .169245D+01,
&END
&D MACH=  1.53,ALTP= 40000.,ETAR= .9320,MODE= 1,NVOPT=  0,IWT= 1,INST= 0,
SPEC(2,11)=  .399817D+03,SPEC(1,9)=  .177783D+01,SPEC(1,8)=  .249634D+01,
SPEC(4,7)=  .351115D+04,SPEC(9,6)=  .516203D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .148208D+01,SPEC(1,3)=  .560675D+00,SPEC(1,2)=  .132278D+01,
SPEC(14,1)=  .621000D+03,SPEC(1,16)=  .103181D+01,SPEC(1,17)=  .100273D+01,
SPEC(1,22)=  .102863D+01,SPEC(8,13)=  .251413D+01,SPEC(5,34)=  .200000D+02,
&END
&D MACH=  1.60,ALTP= 40000.,ETAR= .9320,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .398146D+03,SPEC(1,9)=  .177184D+01,SPEC(1,8)=  .249536D+01,
SPEC(4,7)=  .357340D+04,SPEC(9,6)=  .479295D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .148308D+01,SPEC(1,3)=  .562403D+00,SPEC(1,2)=  .131973D+01,
SPEC(14,1)=  .613000D+03,SPEC(1,16)=  .104296D+01,SPEC(1,17)=  .100547D+01,
SPEC(1,22)=  .102880D+01,SPEC(8,13)=  .266057D+01,SPEC(5,34)=  .200000D+02,
&END
&D MACH=  1.80,ALTP= 40000.,ETAR= .9320,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .381013D+03,SPEC(1,9)=  .176374D+01,SPEC(1,8)=  .249630D+01,
SPEC(4,7)=  .374464D+04,SPEC(9,6)=  .386700D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .148733D+01,SPEC(1,3)=  .570276D+00,SPEC(1,2)=  .131092D+01,
SPEC(14,1)=  .590000D+03,SPEC(1,16)=  .107576D+01,SPEC(1,17)=  .101374D+01,
SPEC(1,22)=  .104230D+01,SPEC(8,13)=  .311973D+01,SPEC(5,34)=  .200000D+02,
&END
&D MACH=  2.10,ALTP= 40000.,ETAR= .9320,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .290099D+03,SPEC(1,9)=  .180255D+01,SPEC(1,8)=  .252711D+01,
SPEC(4,7)=  .375000D+04,SPEC(9,6)=  .301961D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .150332D+01,SPEC(1,3)=  .627412D+00,SPEC(1,2)=  .127920D+01,
SPEC(14,1)=  .526000D+03,SPEC(1,16)=  .110584D+01,SPEC(1,17)=  .979775D+00,
SPEC(1,22)=  .118491D+01,SPEC(8,13)=  .350401D+01,SPEC(5,34)=  .200000D+02,
&END
&D MACH=  1.40,ALTP= 50000.,ETAR= .9348,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .397090D+03,SPEC(1,9)=  .178998D+01,SPEC(1,8)=  .249733D+01,
SPEC(4,7)=  .342876D+04,SPEC(9,6)=  .948457D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .148066D+01,SPEC(1,3)=  .557734D+00,SPEC(1,2)=  .133024D+01,
SPEC(14,1)=  .637000D+03,SPEC(1,16)=  .101306D+01,SPEC(1,17)=  .100081D+01,
SPEC(1,22)=  .102920D+01,SPEC(8,13)=  .228360D+01,SPEC(5,34)=  .200000D+02,
&END
&D MACH=  1.50,ALTP= 50000.,ETAR= .8893,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .399035D+03,SPEC(1,9)=  .177964D+01,SPEC(1,8)=  .249551D+01,
SPEC(4,7)=  .350538D+04,SPEC(9,6)=  .900793D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .148262D+01,SPEC(1,3)=  .561159D+00,SPEC(1,2)=  .132443D+01,
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SPEC(14,1)=  .625000D+03,SPEC(1,16)=  .102702D+01,SPEC(1,17)=  .100250D+01,
SPEC(1,22)=  .102920D+01,SPEC(8,13)=  .240127D+01,SPEC(5,34)=  .200000D+02,
&END
&D MACH= 1.53,ALTP= 50000.,ETAR= .9320,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .397564D+03,SPEC(1,9)=  .177667D+01,SPEC(1,8)=  .249525D+01,
SPEC(4,7)=  .352672D+04,SPEC(9,6)=  .833630D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .148303D+01,SPEC(1,3)=  .561812D+00,SPEC(1,2)=  .132278D+01,
SPEC(14,1)=  .621000D+03,SPEC(1,16)=  .103145D+01,SPEC(1,17)=  .100273D+01,
SPEC(1,22)=  .102911D+01,SPEC(8,13)=  .251449D+01,SPEC(5,34)=  .200000D+02,
&END
&D MACH= 1.60,ALTP= 50000.,ETAR= .9320,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .401809D+03,SPEC(1,9)=  .177063D+01,SPEC(1,8)=  .249426D+01,
SPEC(4,7)=  .358850D+04,SPEC(9,6)=  .773966D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .148376D+01,SPEC(1,3)=  .563418D+00,SPEC(1,2)=  .131973D+01,
SPEC(14,1)=  .613000D+03,SPEC(1,16)=  .104266D+01,SPEC(1,17)=  .100547D+01,
SPEC(1,22)=  .102901D+01,SPEC(8,13)=  .265779D+01,SPEC(5,34)=  .200000D+02,
&END
&D MACH= 1.60,ALTP= 50000.,ETAR= .9320,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .343603D+03,SPEC(1,9)=  .180735D+01,SPEC(1,8)=  .250861D+01,
SPEC(4,7)=  .351368D+04,SPEC(9,6)=  .785203D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .149243D+01,SPEC(1,3)=  .585941D+00,SPEC(1,2)=  .133218D+01,
SPEC(14,1)=  .612926D+03,SPEC(1,16)=  .103806D+01,SPEC(1,17)=  .100425D+01,
SPEC(1,22)=  .108046D+01,SPEC(5,34)=  .210000D+02,SPEC(8,13)=  .258564D+01,
&END
&D MACH= 1.60,ALTP= 50000.,ETAR= .9320,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .309595D+03,SPEC(1,9)=  .190460D+01,SPEC(1,8)=  .253698D+01,
SPEC(4,7)=  .332788D+04,SPEC(9,6)=  .835517D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .150638D+01,SPEC(1,3)=  .678702D+00,SPEC(1,2)=  .139905D+01,
SPEC(14,1)=  .609715D+03,SPEC(1,16)=  .102278D+01,SPEC(1,17)=  .994778D+00,
SPEC(1,22)=  .121493D+01,SPEC(5,34)=  .265150D+02,SPEC(8,13)=  .236625D+01,
&END
&D MACH= 1.60,ALTP= 50000.,ETAR= .9320,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .320439D+03,SPEC(1,9)=  .197145D+01,SPEC(1,8)=  .255467D+01,
SPEC(4,7)=  .317394D+04,SPEC(9,6)=  .902409D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .151254D+01,SPEC(1,3)=  .775112D+00,SPEC(1,2)=  .147897D+01,
SPEC(14,1)=  .596936D+03,SPEC(1,16)=  .100657D+01,SPEC(1,17)=  .972065D+00,
SPEC(1,22)=  .131819D+01,SPEC(5,34)=  .327035D+02,SPEC(8,13)=  .218365D+01,
&END
&D MACH= 1.60,ALTP= 50000.,ETAR= .9320,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .343146D+03,SPEC(1,9)=  .191558D+01,SPEC(1,8)=  .255745D+01,
SPEC(4,7)=  .304938D+04,SPEC(9,6)=  .993475D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .151301D+01,SPEC(1,3)=  .825774D+00,SPEC(1,2)=  .148148D+01,
SPEC(14,1)=  .557700D+03,SPEC(1,16)=  .987688D+00,SPEC(1,17)=  .903780D+00,
SPEC(1,22)=  .129530D+01,SPEC(5,34)=  .362174D+02,SPEC(8,13)=  .210136D+01,
&END
&D MACH= 1.60,ALTP= 50000.,ETAR= .9320,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .350408D+03,SPEC(1,9)=  .188868D+01,SPEC(1,8)=  .256449D+01,
SPEC(4,7)=  .291313D+04,SPEC(9,6)=  .107936D-01,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .151430D+01,SPEC(1,3)=  .867745D+00,SPEC(1,2)=  .146377D+01,
SPEC(14,1)=  .525122D+03,SPEC(1,16)=  .969864D+00,SPEC(1,17)=  .848746D+00,
SPEC(1,22)=  .131628D+01,SPEC(5,34)=  .381561D+02,SPEC(8,13)=  .201402D+01,
&END
&D MACH= 1.60,ALTP= 50000.,ETAR= .9320,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .360245D+03,SPEC(1,9)=  .182161D+01,SPEC(1,8)=  .256034D+01,
SPEC(4,7)=  .278864D+04,SPEC(9,6)=  .117998D-01,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .151221D+01,SPEC(1,3)=  .895097D+00,SPEC(1,2)=  .141838D+01,
SPEC(14,1)=  .487376D+03,SPEC(1,16)=  .950423D+00,SPEC(1,17)=  .788730D+00,
SPEC(1,22)=  .129468D+01,SPEC(5,34)=  .383019D+02,SPEC(8,13)=  .195712D+01,
&END
&D MACH= 1.60,ALTP= 50000.,ETAR= .9320,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .365910D+03,SPEC(1,9)=  .176943D+01,SPEC(1,8)=  .255059D+01,
SPEC(4,7)=  .266858D+04,SPEC(9,6)=  .128841D-01,SPEC(13,5)=  .599105D+01,
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SPEC(1,5)=  .151014D+01,SPEC(1,3)=  .927466D+00,SPEC(1,2)=  .137999D+01,
SPEC(14,1)=  .453985D+03,SPEC(1,16)=  .930739D+00,SPEC(1,17)=  .739806D+00,
SPEC(1,22)=  .129113D+01,SPEC(5,34)=  .380969D+02,SPEC(8,13)=  .189901D+01,
&END
&D MACH=  1.60,ALTP= 50000.,ETAR= .9320,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .370295D+03,SPEC(1,9)=  .174158D+01,SPEC(1,8)=  .254555D+01,
SPEC(4,7)=  .255137D+04,SPEC(9,6)=  .140143D-01,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .151177D+01,SPEC(1,3)=  .978344D+00,SPEC(1,2)=  .135930D+01,
SPEC(14,1)=  .428389D+03,SPEC(1,16)=  .912372D+00,SPEC(1,17)=  .701725D+00,
SPEC(1,22)=  .131646D+01,SPEC(5,34)=  .382707D+02,SPEC(8,13)=  .183223D+01,
&END
&D MACH=  1.80,ALTP= 50000.,ETAR= .9320,MODE= 1,NVOPT=  0,IWT= 1,INST= 0,
SPEC(2,11)=  .382305D+03,SPEC(1,9)=  .176482D+01,SPEC(1,8)=  .249648D+01,
SPEC(4,7)=  .375000D+04,SPEC(9,6)=  .627320D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .148840D+01,SPEC(1,3)=  .578525D+00,SPEC(1,2)=  .131885D+01,
SPEC(14,1)=  .590000D+03,SPEC(1,16)=  .107471D+01,SPEC(1,17)=  .101271D+01,
SPEC(1,22)=  .104455D+01,SPEC(8,13)=  .311122D+01,SPEC(5,34)=  .200000D+02,
&END
&D MACH=  2.10,ALTP= 50000.,ETAR= .9320,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .286074D+03,SPEC(1,9)=  .180857D+01,SPEC(1,8)=  .252868D+01,
SPEC(4,7)=  .374818D+04,SPEC(9,6)=  .487606D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .150440D+01,SPEC(1,3)=  .628459D+00,SPEC(1,2)=  .127708D+01,
SPEC(14,1)=  .526000D+03,SPEC(1,16)=  .110522D+01,SPEC(1,17)=  .980284D+00,
SPEC(1,22)=  .119610D+01,SPEC(8,13)=  .349503D+01,SPEC(5,34)=  .200000D+02,
&END
&D MACH=  2.40,ALTP= 50000.,ETAR= .9320,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .350022D+03,SPEC(1,9)=  .173677D+01,SPEC(1,8)=  .252229D+01,
SPEC(4,7)=  .375000D+04,SPEC(9,6)=  .420093D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .150234D+01,SPEC(1,3)=  .818338D+00,SPEC(1,2)=  .133318D+01,
SPEC(14,1)=  .455000D+03,SPEC(1,16)=  .111869D+01,SPEC(1,17)=  .896230D+00,
SPEC(1,22)=  .121401D+01,SPEC(8,13)=  .383543D+01,SPEC(5,34)=  .200000D+02,
&END
&D MACH=  1.80,ALTP= 55000.,ETAR= .9320,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .368418D+03,SPEC(1,9)=  .176930D+01,SPEC(1,8)=  .249787D+01,
SPEC(4,7)=  .375000D+04,SPEC(9,6)=  .795402D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .149003D+01,SPEC(1,3)=  .575812D+00,SPEC(1,2)=  .131291D+01,
SPEC(14,1)=  .590000D+03,SPEC(1,16)=  .107448D+01,SPEC(1,17)=  .101348D+01,
SPEC(1,22)=  .105298D+01,SPEC(8,13)=  .309616D+01,SPEC(5,34)=  .200000D+02,
&END
&D MACH=  1.80,ALTP= 55000.,ETAR= .9320,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .327982D+03,SPEC(1,9)=  .180527D+01,SPEC(1,8)=  .251205D+01,
SPEC(4,7)=  .367269D+04,SPEC(9,6)=  .806839D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .149718D+01,SPEC(1,3)=  .597233D+00,SPEC(1,2)=  .132217D+01,
SPEC(14,1)=  .589525D+03,SPEC(1,16)=  .106984D+01,SPEC(1,17)=  .101152D+01,
SPEC(1,22)=  .110563D+01,SPEC(5,34)=  .210000D+02,SPEC(8,13)=  .301649D+01,
&END
&D MACH=  1.80,ALTP= 55000.,ETAR= .9320,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .322791D+03,SPEC(1,9)=  .188778D+01,SPEC(1,8)=  .253735D+01,
SPEC(4,7)=  .349944D+04,SPEC(9,6)=  .868765D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .150751D+01,SPEC(1,3)=  .715075D+00,SPEC(1,2)=  .141916D+01,
SPEC(14,1)=  .587915D+03,SPEC(1,16)=  .105398D+01,SPEC(1,17)=  .100038D+01,
SPEC(1,22)=  .121673D+01,SPEC(5,34)=  .293648D+02,SPEC(8,13)=  .274860D+01,
&END
&D MACH=  1.80,ALTP= 55000.,ETAR= .9320,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .337040D+03,SPEC(1,9)=  .193217D+01,SPEC(1,8)=  .255217D+01,
SPEC(4,7)=  .334544D+04,SPEC(9,6)=  .942465D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .151226D+01,SPEC(1,3)=  .809386D+00,SPEC(1,2)=  .148560D+01,
SPEC(14,1)=  .571754D+03,SPEC(1,16)=  .103700D+01,SPEC(1,17)=  .968794D+00,
SPEC(1,22)=  .129688D+01,SPEC(5,34)=  .353158D+02,SPEC(8,13)=  .255759D+01,
&END
&D MACH=  1.80,ALTP= 55000.,ETAR= .9320,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .353615D+03,SPEC(1,9)=  .190473D+01,SPEC(1,8)=  .255897D+01,
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SPEC(4,7)=  .320663D+04,SPEC(9,6)=  .103010D-01,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .151380D+01,SPEC(1,3)=  .866642D+00,SPEC(1,2)=  .149356D+01,
SPEC(14,1)=  .539655D+03,SPEC(1,16)=  .101865D+01,SPEC(1,17)=  .910070D+00,
SPEC(1,22)=  .130914D+01,SPEC(5,34)=  .390440D+02,SPEC(8,13)=  .247246D+01,
&END
&D MACH=  1.80,ALTP= 55000.,ETAR= .9320,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .354715D+03,SPEC(1,9)=  .185719D+01,SPEC(1,8)=  .256175D+01,
SPEC(4,7)=  .305998D+04,SPEC(9,6)=  .111663D-01,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .151380D+01,SPEC(1,3)=  .888181D+00,SPEC(1,2)=  .143951D+01,
SPEC(14,1)=  .503581D+03,SPEC(1,16)=  .999241D+00,SPEC(1,17)=  .849171D+00,
SPEC(1,22)=  .131524D+01,SPEC(5,34)=  .383032D+02,SPEC(8,13)=  .234297D+01,
&END
&D MACH=  1.80,ALTP= 55000.,ETAR= .9320,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .363337D+03,SPEC(1,9)=  .180049D+01,SPEC(1,8)=  .255500D+01,
SPEC(4,7)=  .292902D+04,SPEC(9,6)=  .121906D-01,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .151197D+01,SPEC(1,3)=  .922313D+00,SPEC(1,2)=  .140232D+01,
SPEC(14,1)=  .469607D+03,SPEC(1,16)=  .979077D+00,SPEC(1,17)=  .795237D+00,
SPEC(1,22)=  .130560D+01,SPEC(5,34)=  .387744D+02,SPEC(8,13)=  .227392D+01,
&END
&D MACH=  1.80,ALTP= 55000.,ETAR= .9320,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .370456D+03,SPEC(1,9)=  .175762D+01,SPEC(1,8)=  .254622D+01,
SPEC(4,7)=  .280489D+04,SPEC(9,6)=  .133061D-01,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .151210D+01,SPEC(1,3)=  .965879D+00,SPEC(1,2)=  .137306D+01,
SPEC(14,1)=  .439987D+03,SPEC(1,16)=  .959244D+00,SPEC(1,17)=  .749262D+00,
SPEC(1,22)=  .131234D+01,SPEC(5,34)=  .388507D+02,SPEC(8,13)=  .220210D+01,
&END
&D MACH=  1.80,ALTP= 55000.,ETAR= .9320,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .387009D+03,SPEC(1,9)=  .168978D+01,SPEC(1,8)=  .252250D+01,
SPEC(4,7)=  .269675D+04,SPEC(9,6)=  .146741D-01,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .150794D+01,SPEC(1,3)=  .101650D+01,SPEC(1,2)=  .134815D+01,
SPEC(14,1)=  .409254D+03,SPEC(1,16)=  .937958D+00,SPEC(1,17)=  .701851D+00,
SPEC(1,22)=  .128383D+01,SPEC(5,34)=  .388568D+02,SPEC(8,13)=  .215014D+01,
&END
&D MACH=  2.10,ALTP= 55000.,ETAR= .9320,MODE= 1,NVOPT=  0,IWT= 1,INST= 0,
SPEC(2,11)=  .286367D+03,SPEC(1,9)=  .181028D+01,SPEC(1,8)=  .252905D+01,
SPEC(4,7)=  .375000D+04,SPEC(9,6)=  .620459D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .150492D+01,SPEC(1,3)=  .631461D+00,SPEC(1,2)=  .127860D+01,
SPEC(14,1)=  .526000D+03,SPEC(1,16)=  .110472D+01,SPEC(1,17)=  .979918D+00,
SPEC(1,22)=  .119973D+01,SPEC(8,13)=  .348456D+01,SPEC(5,34)=  .200000D+02,
&END
&D MACH=  2.10,ALTP= 55000.,ETAR= .9320,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .343191D+03,SPEC(1,9)=  .178776D+01,SPEC(1,8)=  .252454D+01,
SPEC(4,7)=  .373289D+04,SPEC(9,6)=  .653713D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .150345D+01,SPEC(1,3)=  .717560D+00,SPEC(1,2)=  .136081D+01,
SPEC(14,1)=  .525589D+03,SPEC(1,16)=  .109685D+01,SPEC(1,17)=  .961341D+00,
SPEC(1,22)=  .116053D+01,SPEC(5,34)=  .288306D+02,SPEC(8,13)=  .338755D+01,
&END
&D MACH=  2.10,ALTP= 55000.,ETAR= .9320,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .357541D+03,SPEC(1,9)=  .186272D+01,SPEC(1,8)=  .255078D+01,
SPEC(4,7)=  .356520D+04,SPEC(9,6)=  .705582D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .151197D+01,SPEC(1,3)=  .854521D+00,SPEC(1,2)=  .146764D+01,
SPEC(14,1)=  .525781D+03,SPEC(1,16)=  .108172D+01,SPEC(1,17)=  .947315D+00,
SPEC(1,22)=  .127004D+01,SPEC(5,34)=  .384081D+02,SPEC(8,13)=  .310199D+01,
&END
&D MACH=  2.10,ALTP= 55000.,ETAR= .9320,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .357910D+03,SPEC(1,9)=  .184136D+01,SPEC(1,8)=  .255581D+01,
SPEC(4,7)=  .340101D+04,SPEC(9,6)=  .762385D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .151281D+01,SPEC(1,3)=  .891430D+00,SPEC(1,2)=  .143314D+01,
SPEC(14,1)=  .496294D+03,SPEC(1,16)=  .106210D+01,SPEC(1,17)=  .893983D+00,
SPEC(1,22)=  .130241D+01,SPEC(5,34)=  .385948D+02,SPEC(8,13)=  .298990D+01,
&END
&D MACH=  2.10,ALTP= 55000.,ETAR= .9320,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
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SPEC(2,11)=  .367806D+03,SPEC(1,9)=  .178071D+01,SPEC(1,8)=  .254553D+01,
SPEC(4,7)=  .325900D+04,SPEC(9,6)=  .833446D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .151016D+01,SPEC(1,3)=  .925243D+00,SPEC(1,2)=  .139539D+01,
SPEC(14,1)=  .462094D+03,SPEC(1,16)=  .104042D+01,SPEC(1,17)=  .836825D+00,
SPEC(1,22)=  .128697D+01,SPEC(5,34)=  .389479D+02,SPEC(8,13)=  .292207D+01,
&END
&D MACH=  2.10,ALTP= 55000.,ETAR= .9320,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .374933D+03,SPEC(1,9)=  .174136D+01,SPEC(1,8)=  .253652D+01,
SPEC(4,7)=  .312162D+04,SPEC(9,6)=  .908830D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .151060D+01,SPEC(1,3)=  .972022D+00,SPEC(1,2)=  .136940D+01,
SPEC(14,1)=  .434061D+03,SPEC(1,16)=  .101973D+01,SPEC(1,17)=  .790188D+00,
SPEC(1,22)=  .129646D+01,SPEC(5,34)=  .390588D+02,SPEC(8,13)=  .283500D+01,
&END
&D MACH=  2.10,ALTP= 55000.,ETAR= .9320,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .375481D+03,SPEC(1,9)=  .171184D+01,SPEC(1,8)=  .252896D+01,
SPEC(4,7)=  .298325D+04,SPEC(9,6)=  .985260D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .151170D+01,SPEC(1,3)=  .101595D+01,SPEC(1,2)=  .134412D+01,
SPEC(14,1)=  .409306D+03,SPEC(1,16)=  .999827D+00,SPEC(1,17)=  .751337D+00,
SPEC(1,22)=  .132323D+01,SPEC(5,34)=  .381873D+02,SPEC(8,13)=  .275004D+01,
&END
&D MACH=  2.10,ALTP= 55000.,ETAR= .9320,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .393935D+03,SPEC(1,9)=  .164135D+01,SPEC(1,8)=  .249842D+01,
SPEC(4,7)=  .287204D+04,SPEC(9,6)=  .108842D-01,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .150574D+01,SPEC(1,3)=  .107184D+01,SPEC(1,2)=  .132449D+01,
SPEC(14,1)=  .380800D+03,SPEC(1,16)=  .977794D+00,SPEC(1,17)=  .702035D+00,
SPEC(1,22)=  .128803D+01,SPEC(5,34)=  .389295D+02,SPEC(8,13)=  .274123D+01,
&END
&D MACH=  2.10,ALTP= 55000.,ETAR= .9320,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .407426D+03,SPEC(1,9)=  .158675D+01,SPEC(1,8)=  .246112D+01,
SPEC(4,7)=  .276127D+04,SPEC(9,6)=  .119850D-01,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .149824D+01,SPEC(1,3)=  .113507D+01,SPEC(1,2)=  .130187D+01,
SPEC(14,1)=  .356367D+03,SPEC(1,16)=  .955732D+00,SPEC(1,17)=  .658224D+00,
SPEC(1,22)=  .127404D+01,SPEC(5,34)=  .389901D+02,SPEC(8,13)=  .263609D+01,
&END
&D MACH=  2.40,ALTP= 55000.,ETAR= .9320,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .344132D+03,SPEC(1,9)=  .174192D+01,SPEC(1,8)=  .252418D+01,
SPEC(4,7)=  .375000D+04,SPEC(9,6)=  .532190D-02,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .150346D+01,SPEC(1,3)=  .813637D+00,SPEC(1,2)=  .132871D+01,
SPEC(14,1)=  .455000D+03,SPEC(1,16)=  .111885D+01,SPEC(1,17)=  .897586D+00,
SPEC(1,22)=  .122358D+01,SPEC(8,13)=  .383252D+01,SPEC(5,34)=  .200000D+02,
&END
&D MACH=  1.50,ALTP= 60000.,ETAR= .8893,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .403188D+03,SPEC(1,9)=  .177531D+01,SPEC(1,8)=  .249264D+01,
SPEC(4,7)=  .353739D+04,SPEC(9,6)=  .145416D-01,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .148357D+01,SPEC(1,3)=  .562427D+00,SPEC(1,2)=  .132443D+01,
SPEC(14,1)=  .625000D+03,SPEC(1,16)=  .102664D+01,SPEC(1,17)=  .100250D+01,
SPEC(1,22)=  .102680D+01,SPEC(8,13)=  .240492D+01,SPEC(5,34)=  .200000D+02,
&END
&D MACH=  1.53,ALTP= 60000.,ETAR= .9320,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .403049D+03,SPEC(1,9)=  .177247D+01,SPEC(1,8)=  .249249D+01,
SPEC(4,7)=  .355690D+04,SPEC(9,6)=  .134561D-01,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .148379D+01,SPEC(1,3)=  .562913D+00,SPEC(1,2)=  .132278D+01,
SPEC(14,1)=  .621000D+03,SPEC(1,16)=  .103113D+01,SPEC(1,17)=  .100273D+01,
SPEC(1,22)=  .102654D+01,SPEC(8,13)=  .251838D+01,SPEC(5,34)=  .200000D+02,
&END
&D MACH=  1.60,ALTP= 60000.,ETAR= .9320,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
SPEC(2,11)=  .409156D+03,SPEC(1,9)=  .176552D+01,SPEC(1,8)=  .249113D+01,
SPEC(4,7)=  .361933D+04,SPEC(9,6)=  .124885D-01,SPEC(13,5)=  .599105D+01,
SPEC(1,5)=  .148418D+01,SPEC(1,3)=  .563940D+00,SPEC(1,2)=  .131973D+01,
SPEC(14,1)=  .613000D+03,SPEC(1,16)=  .104248D+01,SPEC(1,17)=  .100547D+01,
SPEC(1,22)=  .102479D+01,SPEC(8,13)=  .266319D+01,SPEC(5,34)=  .200000D+02,
&END
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&D MACH=  1.80,ALTP= 60000.,ETAR= .9320,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
 SPEC(2,11)=  .361233D+03,SPEC(1,9)=  .177347D+01,SPEC(1,8)=  .249921D+01,
 SPEC(4,7)=  .375000D+04,SPEC(9,6)=  .101299D-01,SPEC(13,5)=  .599105D+01,
 SPEC(1,5)=  .149163D+01,SPEC(1,3)=  .580256D+00,SPEC(1,2)=  .131522D+01,
 SPEC(14,1)=  .590000D+03,SPEC(1,16)=  .107358D+01,SPEC(1,17)=  .101318D+01,
 SPEC(1,22)=  .106033D+01,SPEC(8,13)=  .309457D+01,SPEC(5,34)=  .200000D+02,
&END
&D MACH=  2.10,ALTP= 60000.,ETAR= .9320,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
 SPEC(2,11)=  .290832D+03,SPEC(1,9)=  .181107D+01,SPEC(1,8)=  .252950D+01,
 SPEC(4,7)=  .375000D+04,SPEC(9,6)=  .794051D-02,SPEC(13,5)=  .599105D+01,
 SPEC(1,5)=  .150559D+01,SPEC(1,3)=  .644056D+00,SPEC(1,2)=  .128908D+01,
 SPEC(14,1)=  .526000D+03,SPEC(1,16)=  .110332D+01,SPEC(1,17)=  .977391D+00,
 SPEC(1,22)=  .120142D+01,SPEC(8,13)=  .346154D+01,SPEC(5,34)=  .200000D+02,
&END
&D MACH=  2.40,ALTP= 60000.,ETAR= .9320,MODE= 1,NVOPT=  0,IWT= 1,INST= 0,
 SPEC(2,11)=  .342781D+03,SPEC(1,9)=  .174475D+01,SPEC(1,8)=  .252515D+01,
 SPEC(4,7)=  .375000D+04,SPEC(9,6)=  .676955D-02,SPEC(13,5)=  .599105D+01,
 SPEC(1,5)=  .150433D+01,SPEC(1,3)=  .816553D+00,SPEC(1,2)=  .132911D+01,
 SPEC(14,1)=  .455000D+03,SPEC(1,16)=  .111827D+01,SPEC(1,17)=  .897466D+00,
 SPEC(1,22)=  .122990D+01,SPEC(8,13)=  .381686D+01,SPEC(5,34)=  .200000D+02,
&END
&D MACH=  2.40,ALTP= 60000.,ETAR= .9320,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
 SPEC(2,11)=  .331868D+03,SPEC(1,9)=  .177402D+01,SPEC(1,8)=  .253840D+01,
 SPEC(4,7)=  .367683D+04,SPEC(9,6)=  .686676D-02,SPEC(13,5)=  .599105D+01,
 SPEC(1,5)=  .150980D+01,SPEC(1,3)=  .836503D+00,SPEC(1,2)=  .132969D+01,
 SPEC(14,1)=  .453485D+03,SPEC(1,16)=  .111354D+01,SPEC(1,17)=  .894411D+00,
 SPEC(1,22)=  .128733D+01,SPEC(5,34)=  .313403D+02,SPEC(8,13)=  .372717D+01,
&END
&D MACH=  2.40,ALTP= 60000.,ETAR= .9320,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
 SPEC(2,11)=  .366268D+03,SPEC(1,9)=  .176979D+01,SPEC(1,8)=  .254246D+01,
 SPEC(4,7)=  .352965D+04,SPEC(9,6)=  .750863D-02,SPEC(13,5)=  .599105D+01,
 SPEC(1,5)=  .151324D+01,SPEC(1,3)=  .959475D+00,SPEC(1,2)=  .137581D+01,
 SPEC(14,1)=  .442488D+03,SPEC(1,16)=  .109389D+01,SPEC(1,17)=  .859450D+00,
 SPEC(1,22)=  .132006D+01,SPEC(5,34)=  .389222D+02,SPEC(8,13)=  .352249D+01,
&END
&D MACH=  2.40,ALTP= 60000.,ETAR= .9320,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
 SPEC(2,11)=  .381089D+03,SPEC(1,9)=  .170958D+01,SPEC(1,8)=  .252282D+01,
 SPEC(4,7)=  .339215D+04,SPEC(9,6)=  .824750D-02,SPEC(13,5)=  .599105D+01,
 SPEC(1,5)=  .151054D+01,SPEC(1,3)=  .101072D+01,SPEC(1,2)=  .135263D+01,
 SPEC(14,1)=  .413391D+03,SPEC(1,16)=  .107097D+01,SPEC(1,17)=  .807963D+00,
 SPEC(1,22)=  .130103D+01,SPEC(5,34)=  .390745D+02,SPEC(8,13)=  .345174D+01,
&END
&D MACH=  2.40,ALTP= 60000.,ETAR= .9320,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
 SPEC(2,11)=  .385826D+03,SPEC(1,9)=  .166782D+01,SPEC(1,8)=  .250849D+01,
 SPEC(4,7)=  .325055D+04,SPEC(9,6)=  .898487D-02,SPEC(13,5)=  .599105D+01,
 SPEC(1,5)=  .150959D+01,SPEC(1,3)=  .105787D+01,SPEC(1,2)=  .133095D+01,
 SPEC(14,1)=  .388356D+03,SPEC(1,16)=  .104984D+01,SPEC(1,17)=  .763890D+00,
 SPEC(1,22)=  .130943D+01,SPEC(5,34)=  .388284D+02,SPEC(8,13)=  .337109D+01,
&END
&D MACH=  2.40,ALTP= 60000.,ETAR= .9320,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
 SPEC(2,11)=  .420342D+03,SPEC(1,9)=  .157360D+01,SPEC(1,8)=  .244293D+01,
 SPEC(4,7)=  .315080D+04,SPEC(9,6)=  .101011D-01,SPEC(13,5)=  .599105D+01,
 SPEC(1,5)=  .149369D+01,SPEC(1,3)=  .112535D+01,SPEC(1,2)=  .130341D+01,
 SPEC(14,1)=  .356767D+03,SPEC(1,16)=  .102228D+01,SPEC(1,17)=  .703446D+00,
 SPEC(1,22)=  .123504D+01,SPEC(5,34)=  .392312D+02,SPEC(8,13)=  .337045D+01,
&END
&D MACH=  2.40,ALTP= 60000.,ETAR= .9320,MODE= 1,NVOPT=  0,IWT= 0,INST= 0,
 SPEC(2,11)=  .456653D+03,SPEC(1,9)=  .151309D+01,SPEC(1,8)=  .237526D+01,
 SPEC(4,7)=  .304989D+04,SPEC(9,6)=  .113063D-01,SPEC(13,5)=  .599105D+01,
 SPEC(1,5)=  .147703D+01,SPEC(1,3)=  .123197D+01,SPEC(1,2)=  .128738D+01,
 SPEC(14,1)=  .334728D+03,SPEC(1,16)=  .995487D+00,SPEC(1,17)=  .655408D+00,
 SPEC(1,22)=  .120276D+01,SPEC(5,34)=  .393235D+02,SPEC(8,13)=  .332835D+01,
```

```
&END
&D MACH= 2.40,ALTP= 60000.,ETAR= .9320,MODE= 1,NVOPT= 0,IWT= 0,INST= 0,
SPEC(2,11)= .531038D+03,SPEC(1,9)= .143997D+01,SPEC(1,8)= .227728D+01,
SPEC(4,7)= .297365D+04,SPEC(9,6)= .128931D-01,SPEC(13,5)= .599105D+01,
SPEC(1,5)= .145087D+01,SPEC(1,3)= .139009D+01,SPEC(1,2)= .127643D+01,
SPEC(14,1)= .314326D+03,SPEC(1,16)= .964898D+00,SPEC(1,17)= .605968D+00,
SPEC(1,22)= .114633D+01,SPEC(5,34)= .391411D+02,SPEC(8,13)= .330761D+01,
&END
&D MACH= 2.40,ALTP= 60000.,ETAR= .9320,MODE= 1,NVOPT= 0,IWT= 0,INST= 0,
SPEC(2,11)= .608298D+03,SPEC(1,9)= .137628D+01,SPEC(1,8)= .220870D+01,
SPEC(4,7)= .287905D+04,SPEC(9,6)= .144427D-01,SPEC(13,5)= .599105D+01,
SPEC(1,5)= .143413D+01,SPEC(1,3)= .154469D+01,SPEC(1,2)= .126995D+01,
SPEC(14,1)= .298751D+03,SPEC(1,16)= .938802D+00,SPEC(1,17)= .567402D+00,
SPEC(1,22)= .110956D+01,SPEC(5,34)= .391913D+02,SPEC(8,13)= .327507D+01,
&END
&D MACH= 1.80,ALTP= 65000.,ETAR= .9320,MODE= 1,NVOPT= 0,IWT= 0,INST= 0,
SPEC(2,11)= .338161D+03,SPEC(1,9)= .178649D+01,SPEC(1,8)= .250367D+01,
SPEC(4,7)= .373711D+04,SPEC(9,6)= .128815D-01,SPEC(13,5)= .599105D+01,
SPEC(1,5)= .149510D+01,SPEC(1,3)= .582498D+00,SPEC(1,2)= .131091D+01,
SPEC(14,1)= .590000D+03,SPEC(1,16)= .107222D+01,SPEC(1,17)= .101373D+01,
SPEC(1,22)= .108204D+01,SPEC(8,13)= .305806D+01,SPEC(5,34)= .200000D+02,
&END
&D MACH= 2.10,ALTP= 65000.,ETAR= .9320,MODE= 1,NVOPT= 0,IWT= 0,INST= 0,
SPEC(2,11)= .280841D+03,SPEC(1,9)= .182016D+01,SPEC(1,8)= .253138D+01,
SPEC(4,7)= .374990D+04,SPEC(9,6)= .100323D-01,SPEC(13,5)= .599105D+01,
SPEC(1,5)= .150678D+01,SPEC(1,3)= .635771D+00,SPEC(1,2)= .127706D+01,
SPEC(14,1)= .526000D+03,SPEC(1,16)= .110339D+01,SPEC(1,17)= .980286D+00,
SPEC(1,22)= .121869D+01,SPEC(8,13)= .345629D+01,SPEC(5,34)= .200000D+02,
&END
&D MACH= 2.40,ALTP= 65000.,ETAR= .9320,MODE= 1,NVOPT= 0,IWT= 0,INST= 0,
SPEC(2,11)= .336376D+03,SPEC(1,9)= .175160D+01,SPEC(1,8)= .252757D+01,
SPEC(4,7)= .375000D+04,SPEC(9,6)= .857881D-02,SPEC(13,5)= .599105D+01,
SPEC(1,5)= .150590D+01,SPEC(1,3)= .812881D+00,SPEC(1,2)= .132450D+01,
SPEC(14,1)= .455000D+03,SPEC(1,16)= .111818D+01,SPEC(1,17)= .898882D+00,
SPEC(1,22)= .124314D+01,SPEC(8,13)= .381330D+01,SPEC(5,34)= .200000D+02,
&END
&D MACH= 1.80,ALTP= 70000.,ETAR= .9320,MODE= 1,NVOPT= 0,IWT= 0,INST= 0,
SPEC(2,11)= .343840D+03,SPEC(1,9)= .179313D+01,SPEC(1,8)= .250584D+01,
SPEC(4,7)= .375000D+04,SPEC(9,6)= .166716D-01,SPEC(13,5)= .599105D+01,
SPEC(1,5)= .149741D+01,SPEC(1,3)= .609306D+00,SPEC(1,2)= .133631D+01,
SPEC(14,1)= .590000D+03,SPEC(1,16)= .107203D+01,SPEC(1,17)= .101342D+01,
SPEC(1,22)= .109131D+01,SPEC(8,13)= .301269D+01,SPEC(5,34)= .200000D+02,
&END
&D MACH= 2.10,ALTP= 70000.,ETAR= .9320,MODE= 1,NVOPT= 0,IWT= 0,INST= 0,
SPEC(2,11)= .277272D+03,SPEC(1,9)= .183687D+01,SPEC(1,8)= .253587D+01,
SPEC(4,7)= .375000D+04,SPEC(9,6)= .128637D-01,SPEC(13,5)= .599105D+01,
SPEC(1,5)= .150905D+01,SPEC(1,3)= .648244D+00,SPEC(1,2)= .128111D+01,
SPEC(14,1)= .526000D+03,SPEC(1,16)= .110406D+01,SPEC(1,17)= .982142D+00,
SPEC(1,22)= .124721D+01,SPEC(8,13)= .340667D+01,SPEC(5,34)= .200000D+02,
&END
&D MACH= 2.40,ALTP= 70000.,ETAR= .9320,MODE= 1,NVOPT= 0,IWT= 0,INST= 0,
SPEC(2,11)= .338963D+03,SPEC(1,9)= .175999D+01,SPEC(1,8)= .253098D+01,
SPEC(4,7)= .375000D+04,SPEC(9,6)= .110523D-01,SPEC(13,5)= .599105D+01,
SPEC(1,5)= .150815D+01,SPEC(1,3)= .835491D+00,SPEC(1,2)= .133418D+01,
SPEC(14,1)= .455000D+03,SPEC(1,16)= .111819D+01,SPEC(1,17)= .898505D+00,
SPEC(1,22)= .126167D+01,SPEC(8,13)= .375271D+01,SPEC(5,34)= .200000D+02,
&END
&D MACH= 2.10,ALTP= 80000.,ETAR= .9320,MODE= 1,NVOPT= 0,IWT= 0,INST= 0,
SPEC(2,11)= .264181D+03,SPEC(1,9)= .189311D+01,SPEC(1,8)= .254680D+01,
SPEC(4,7)= .374367D+04,SPEC(9,6)= .210389D-01,SPEC(13,5)= .599105D+01,
SPEC(1,5)= .151474D+01,SPEC(1,3)= .671756D+00,SPEC(1,2)= .127706D+01,
SPEC(14,1)= .526000D+03,SPEC(1,16)= .110508D+01,SPEC(1,17)= .989836D+00,
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SPEC(1,22)= .134475D+01,SPEC(8,13)= .329519D+01,SPEC(5,34)= .200000D+02,
&END
&D MACH= 2.40,ALTP= 80000.,ETAR= .9320,MODE= 1,NVOPT= 0,IWT= 2,INST= 0,
SPEC(2,11)= .343524D+03,SPEC(1,9)= .178600D+01,SPEC(1,8)= .254050D+01,
SPEC(4,7)= .375000D+04,SPEC(9,6)= .183549D-01,SPEC(13,5)= .599105D+01,
SPEC(1,5)= .151472D+01,SPEC(1,3)= .890543D+00,SPEC(1,2)= .135501D+01,
SPEC(14,1)= .455000D+03,SPEC(1,16)= .111773D+01,SPEC(1,17)= .898571D+00,
SPEC(1,22)= .131852D+01,SPEC(8,13)= .363147D+01,SPEC(5,34)= .200000D+02,
&END
/*&D IWT=2,NVOPT=0,DEBUG=0, &END */
&W IPLT=T,ISII=F,ISIO=F,IOUTCD=2,PLOT=F,ACCS=0.11859149,
  ILENG(1)=2,3,4,5,6,7,8,9,10,11,12,13,
  DISKWT=0,DISKWC=1,
  IWMEC(1,2)=41, 1, 1, 4, 0, 0, 0,
  IWMEC(1,3)=7, 0, 0, 0, 0, 0, 0,
  IWMEC(1,4)=2, 2, 0, 0, 0, 0, 0,
  IWMEC(1,5)=47, 1, 0, 4, 0, 0, 0,
  IWMEC(1,6)=2, 2, 0, 0, 0, 0, 0,
  IWMEC(1,7)=21, 1, 0, 0, 0, 0, 0,
  IWMEC(1,8)=51, 0, 5,-2, 0, 0, 0,
  IWMEC(1,9)=52, 1, 2,-2, 2, 0, 0,
  IWMEC(1,10)=2, 1, 0, 0, 0, 0, 0,
  IWMEC(1,11)=82, 0, 0, 0, 0, 0, 0,
  IWMEC(1,12)=23, 0, 0, 0, 0, 0, 0,
  IWMEC(1,13)=9, 2,11, 2, 0, 0, 0,
  IWMEC(1,14)=2, 3, 0, 0, 0, 0, 0,
  IWMEC(1,16)=11, 2, 8, 0, 0, 0, 5,
  IWMEC(1,17)=11, 1, 9, 0, 0, 0, 2,
  DESVAL(1,2)=.60,2.10,.38,1.10,3.0,2.0,.50,0,0,1.,0.120,3,1,
              1,0,1.8,0,0,1650.,0.120,1.,1.,.95,1,0.120,
  DESVAL(1,3)=15*0,
  DESVAL(1,4)=.50,2.50,0,-1,10*0,5.,
  DESVAL(1,5)=.50,1.63,.765,1.10,2.0,1.4,.35,0,0,1.,0.160,3,1,
              1,0,1.2,0,0,1175.,0.160,1.,1.,0,0,0.160,
  DESVAL(1,6)=.33,5.75,   0,  -1, 10*0, 2.0,
  DESVAL(1,7)=200.,.0075, 3*0, .20, .20,10*0,
  DESVAL(1,8)=.25,.285,1.05,2.0,2.0,.45,175000.,3,1.,0,.323,0,.28,0,0,
  DESVAL(1,9)=.43,.610,1.05,2.5,3.5,.50,200000.,2,1.,0,.323,0,.28,0,0,
  DESVAL(1,10)=.60,0.5,0,-1,10*0,5.,
  DESVAL(1,11)=0.50,8,12*0,1.5,
  DESVAL(1,12)=550.,.00000005,12*0,0.0001,
  DESVAL(1,13)=3.95,0.55,12*0,1.13,
  DESVAL(1,14)=.50,0.,0,-1,10*0,1.5,
  DESVAL(1,16)=80000.,.240,13*0,
  DESVAL(1,17)=80000.,.240,13*0,
&END
```

A.4 Listing of *supersonic.maps*

The NNEP code interpolates user-supplied functions to estimate component performance. These functions (data tables) can have up to three independent variables. Cubic Spline interpolation is employed to obtain the value of the dependent variable corresponding to the current values of the independent variables. In this file, performance maps for compressor and turbine may be defined. Three map properties are defined in the map file: pressure ratio, corrected flow and efficiency. For further details, refer to the NNEP user's manual [Ref 1].

Listing of "*supersonic.maps*"

```
6969    Generic 2D/AXI Nozzle Drag:  Z=A9/A10, Y=Beta, X=M0
 Z  5   0.1000    0.2500    0.5000    0.7500    1.0000
 Y  9   0.0000    2.0000    4.0000    6.0000    8.0000    10.000    12.000
        14.000    16.000
 X 12   0.0000    0.6000    0.8000    0.9000    0.9500    1.0000    1.0200
        1.2000    1.5000    2.0000    2.5000    3.0000
CD 12   0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
        0.0000    0.0000    0.0000    0.0000    0.0000
CD 12   0.0000    0.0100    0.0150    0.0200    0.0180    0.0170    0.0150
        0.0120    0.0100    0.0080    0.0075    0.0070
CD 12   0.0000    0.0180    0.0260    0.0260    0.0310    0.0400    0.0420
        0.0370    0.0310    0.0250    0.0210    0.0200
CD 12   0.0000    0.0230    0.0350    0.0370    0.0460    0.0670    0.0860
        0.0720    0.0570    0.0460    0.0380    0.0340
CD 12   0.0000    0.0290    0.0450    0.0530    0.0670    0.1350    0.1310
        0.1120    0.0890    0.0690    0.0570    0.0470
CD 12   0.0000    0.0350    0.0530    0.0680    0.0900    0.1600    0.1860
        0.1540    0.1230    0.0910    0.0740    0.0610
CD 12   0.0000    0.0400    0.0610    0.0830    0.1100    0.1850    0.2500
        0.2000    0.1580    0.1200    0.0920    0.0750
CD 12   0.0000    0.0450    0.0680    0.0930    0.1350    0.2200    0.3100
        0.2500    0.1910    0.1410    0.1090    0.0880
CD 12   0.0000    0.0500    0.0750    0.1100    0.1700    0.2550    0.4200
        0.3050    0.2250    0.1580    0.1230    0.1000
 Y  9   0.0000    2.0000    4.0000    6.0000    8.0000    10.000    12.000
        14.000    16.000
 X 12   0.0000    0.6000    0.8000    0.9000    0.9500    1.0000    1.0200
        1.2000    1.5000    2.0000    2.5000    3.0000
CD 12   0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
        0.0000    0.0000    0.0000    0.0000    0.0000
CD 12   0.0000    0.0100    0.0150    0.0200    0.0180    0.0170    0.0150
        0.0120    0.0100    0.0080    0.0075    0.0070
CD 12   0.0000    0.0180    0.0260    0.0260    0.0310    0.0400    0.0420
        0.0370    0.0310    0.0250    0.0210    0.0200
CD 12   0.0000    0.0230    0.0350    0.0370    0.0460    0.0650    0.0860
        0.0710    0.0570    0.0450    0.0370    0.0330
CD 12   0.0000    0.0290    0.0450    0.0530    0.0670    0.1100    0.1310
        0.1110    0.0860    0.0650    0.0520    0.0430
CD 12   0.0000    0.0350    0.0530    0.0680    0.0880    0.1500    0.1850
        0.1530    0.1180    0.0870    0.0670    0.0550
CD 12   0.0000    0.0400    0.0610    0.0830    0.1040    0.1800    0.2500
        0.1980    0.1470    0.1050    0.0800    0.0650
CD 12   0.0000    0.0450    0.0680    0.0920    0.1150    0.2150    0.3050
        0.2420    0.1770    0.1250    0.0940    0.0750
CD 12   0.0000    0.0500    0.0750    0.1000    0.1200    0.2400    0.4150
        0.2860    0.2050    0.1400    0.1050    0.0850
 Y  9   0.0000    2.0000    4.0000    6.0000    8.0000    10.000    12.000
        14.000    16.000
 X 12   0.0000    0.6000    0.8000    0.9000    0.9500    1.0000    1.0200
        1.2000    1.5000    2.0000    2.5000    3.0000
CD 12   0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
        0.0000    0.0000    0.0000    0.0000    0.0000
CD 12   0.0000    0.0100    0.0150    0.0190    0.0170    0.0160    0.0150
        0.0110    0.0090    0.0070    0.0065    0.0060
CD 12   0.0000    0.0170    0.0250    0.0250    0.0300    0.0380    0.0420
        0.0370    0.0290    0.0220    0.0180    0.0160
CD 12   0.0000    0.0230    0.0340    0.0350    0.0450    0.0600    0.0820
        0.0690    0.0510    0.0370    0.0300    0.0250
CD 12   0.0000    0.0290    0.0430    0.0500    0.0650    0.1000    0.1250
        0.1020    0.0750    0.0510    0.0400    0.0330
```

Listing of "*supersonic.maps*" (Continued)

```
 CD 12   0.0000   0.0350   0.0510   0.0650   0.0850   0.1400   0.1700
         0.1400   0.0970   0.0660   0.0500   0.0410
 CD 12   0.0000   0.0400   0.0590   0.0790   0.1000   0.1600   0.2100
         0.1670   0.1180   0.0790   0.0590   0.0470
 CD 12   0.0000   0.0450   0.0670   0.0870   0.1100   0.1750   0.2500
         0.1980   0.1360   0.0900   0.0670   0.0530
 CD 12   0.0000   0.0500   0.0750   0.0950   0.1150   0.1850   0.3000
         0.2270   0.1560   0.1010   0.0740   0.0590
  Y  9   0.0000   2.0000   4.0000   6.0000   8.0000   10.000   12.000
         14.000   16.000
  X 12   0.0000   0.6000   0.8000   0.9000   0.9500   1.0000   1.0200
         1.2000   1.5000   2.0000   2.5000   3.0000
 CD 12   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
         0.0000   0.0000   0.0000   0.0000   0.0000
 CD 12   0.0000   0.0100   0.0150   0.0180   0.0170   0.0150   0.0140
         0.0100   0.0080   0.0060   0.0050   0.0040
 CD 12   0.0000   0.0160   0.0210   0.0250   0.0250   0.0300   0.0340
         0.0280   0.0210   0.0150   0.0110   0.0100
 CD 12   0.0000   0.0200   0.0250   0.0300   0.0350   0.0470   0.0600
         0.0480   0.0340   0.0230   0.0170   0.0140
 CD 12   0.0000   0.0240   0.0290   0.0350   0.0450   0.0700   0.1850
         0.0660   0.0460   0.0300   0.0220   0.0180
 CD 12   0.0000   0.0280   0.0330   0.0400   0.0500   0.0820   0.1100
         0.0840   0.0570   0.0380   0.0270   0.0210
 CD 12   0.0000   0.0320   0.0370   0.0450   0.0550   0.0900   0.1400
         0.1000   0.0650   0.0430   0.0320   0.0240
 CD 12   0.0000   0.0360   0.0410   0.0500   0.0600   0.0950   0.1600
         0.1140   0.0760   0.0490   0.0360   0.0270
 CD 12   0.0000   0.0400   0.0450   0.0550   0.0650   0.1000   0.1800
         0.1270   0.0850   0.0540   0.0390   0.0300
  Y  9   0.0000   2.0000   4.0000   6.0000   8.0000   10.000   12.000
         14.000   16.000
  X 12   0.0000   0.6000   0.8000   0.9000   0.9500   1.0000   1.0200
         1.2000   1.5000   2.0000   2.5000   3.0000
 CD 12   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
         0.0000   0.0000   0.0000   0.0000   0.0000
 CD 12   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
         0.0000   0.0000   0.0000   0.0000   0.0000
 CD 12   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
         0.0000   0.0000   0.0000   0.0000   0.0000
 CD 12   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
         0.0000   0.0000   0.0000   0.0000   0.0000
 CD 12   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
         0.0000   0.0000   0.0000   0.0000   0.0000
 CD 12   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
         0.0000   0.0000   0.0000   0.0000   0.0000
 CD 12   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
         0.0000   0.0000   0.0000   0.0000   0.0000
 CD 12   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
         0.0000   0.0000   0.0000   0.0000   0.0000
 CD 12   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
         0.0000   0.0000   0.0000   0.0000   0.0000
EOT
 3000      G.E./P&W 7 STG HPC WITH 3 STGS OF VAR GEOM STATOR INCORPORATED
ANGL  1       0.000
SPED 12       0.40     0.50     0.60     0.70     0.750    0.800    0.850
              0.900    0.950    1.000    1.050    1.100
R     7       1.000    1.100    1.200    1.300    1.400    1.500    1.600
FLOW  7      15.994   16.294   16.540   16.741   16.903   17.033   17.170
FLOW  7      21.408   21.782   22.056   22.251   22.389   22.486   22.573
FLOW  7      28.875   29.424   29.769   29.967   30.076   30.131   30.154
FLOW  7      39.774   40.675   41.150   41.356   41.427   41.434   41.434
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FLOW  7      46.638    47.890    48.497    48.721    48.780    48.781    48.781
FLOW  7      55.389    57.123    57.858    58.080    58.125    58.125    58.125
FLOW  7      66.286    68.698    69.514    69.707    69.738    69.738    69.738
FLOW  7      77.297    80.039    80.805    80.958    80.973    80.973    80.973
FLOW  7      87.596    90.215    90.852    90.963    90.967    90.967    90.967
FLOW  7      97.727    99.901    100.36    100.42    100.42    100.42    100.42
FLOW  7      102.33    103.54    103.82    103.90    103.91    103.91    103.91
FLOW  7      105.16    105.72    105.88    105.94    105.97    105.99    106.00
EOT
 3001        G.E./P&W 7 STG HPC WITH 3 STGS OF VAR GEOM STATOR INCORPORATED
ANGL  1      0.000
SPED 12      0.40      0.50      0.60      0.70      0.750     0.800     0.850
             0.900     0.950     1.000     1.050     1.100
R     7      1.000     1.100     1.200     1.300     1.400     1.500     1.600
EFF   7      0.7640    0.7448    0.7232    0.6988    0.6698    0.6363    0.5849
EFF   7      0.7651    0.7462    0.7249    0.6992    0.6693    0.6361    0.5878
EFF   7      0.7866    0.7698    0.7504    0.7255    0.6966    0.6652    0.6209
EFF   7      0.8196    0.8076    0.7910    0.7662    0.7364    0.7045    0.6614
EFF   7      0.8396    0.8315    0.8167    0.7907    0.7593    0.7261    0.6822
EFF   7      0.8555    0.8544    0.8408    0.8111    0.7759    0.7401    0.6941
EFF   7      0.8588    0.8676    0.8531    0.8183    0.7799    0.7424    0.6956
EFF   7      0.8588    0.8708    0.8532    0.8165    0.7779    0.7409    0.6956
EFF   7      0.8585    0.8683    0.8467    0.8094    0.7779    0.7409    0.6956
EFF   7      0.8521    0.8558    0.8292    0.7920    0.7555    0.7215    0.6803
EFF   7      0.8356    0.8338    0.8050    0.7692    0.7347    0.7025    0.6635
EFF   7      0.8083    0.7999    0.7691    0.7346    0.7016    0.6711    0.6342
EOT
 3002        G.E./P&W 7 STG HPC WITH 3 STGS OF VAR GEOM STATOR INCORPORATED
ANGL  1      0.000
SPED 12      0.40      0.50      0.60      0.70      0.750     0.800     0.850
             0.900     0.950     1.000     1.050     1.100
R     7      1.000     1.100     1.200     1.300     1.400     1.500     1.600
PR    7      2.2607    2.1006    1.9599    1.8354    1.7241    1.6244    1.5067
PR    7      3.1187    2.8311    2.5864    2.3752    2.1923    2.0329    1.8508
PR    7      4.6343    4.1032    3.6672    3.3040    3.0002    2.7435    2.4584
PR    7      6.9901    6.0771    5.3400    4.7372    4.2440    3.8378    3.4026
PR    7      8.5954    7.4235    6.4748    5.7051    5.0834    4.5785    4.0430
PR    7      10.770    9.2652    8.0253    7.0245    6.2278    5.5889    4.9165
PR    7      13.633    11.689    10.047    8.7419    7.7201    6.9090    6.0601
PR    7      16.647    14.194    12.142    10.532    9.2837    8.2978    7.2687
PR    7      19.691    16.683    14.215    12.311    10.844    9.6883    8.4829
PR    7      22.992    19.337    16.416    14.213    12.524    11.194    9.8054
PR    7      24.412    20.283    17.234    14.959    13.209    11.824    10.373
PR    7      25.214    20.832    17.702    15.381    13.595    12.179    10.693
EOT
 2114        GE21FAN1 FRONT FAN
ANGL  1      0.000
SPED 13      0.500     0.550     0.600     0.650     0.700     0.750     0.800
             0.850     0.900     0.95      1.000     1.050     1.100
R     5      1.000     1.100     1.200     1.300     1.400
FLOW  5      274.541   303.552   329.934   356.417   376.361
R     6      1.000     1.100     1.200     1.300     1.400     1.500
FLOW  6      297.911   328.097   356.701   382.013   402.611   414.456
R     7      1.000     1.100     1.200     1.300     1.400     1.500     1.600
FLOW  7      328.874   359.061   386.751   411.279   431.221   441.756   450.076
R     8      1.000     1.100     1.200     1.300     1.400     1.500     1.600
             1.700
FLOW  8      366.535   395.414   422.183   445.135   463.241   472.466   478.951
             484.258
FLOW  8      406.564   434.136   459.850   481.489   496.840   505.148   510.055
             514.838
R     9      1.000     1.100     1.200     1.300     1.400     1.500     1.600
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Listing of "*supersonic.maps*" (Continued)

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                  1.700      1.800
 FLOW  9        447.768    474.810    497.647    517.842    531.616    538.745    542.473
                545.425    547.445
 FLOW  9        488.584    513.393    535.704    553.801    565.218    571.160    573.842
                575.348    576.316
 R    10          1.000      1.100      1.200      1.300      1.400      1.500      1.600
                  1.700      1.800      1.900
 FLOW 10        536.346    557.753    575.994    590.555    599.866    604.099    605.472
                606.056    606.110    606.302
 FLOW 10        582.938    601.843    617.596    628.351    635.301    636.914    637.891
                637.687    637.473    637.535
 R    11          1.000      1.100      1.200      1.300      1.400      1.500      1.600
                  1.700      1.800      1.900      2.000
 FLOW 11        628.082    645.282    657.489    666.272    670.343    671.034    670.965
                671.019    670.811    670.733    670.520
 FLOW 11        671.394    685.176    693.196    700.007    701.577    701.088    701.150
                701.463    701.253    701.436    700.959
 FLOW 11        703.798    712.469    718.770    721.134    721.525    721.561    721.626
                721.810    721.466    721.254    721.041
 FLOW 11        722.500    728.000    732.000    734.000    734.000    734.500    734.500
                734.000    734.000    734.000    734.000
 EOT
  2115       GE21FAN1 FRONT FAN
 ANGL  1          0.000
 SPED 13          0.500      0.550      0.600      0.650      0.700      0.750      0.800
                  0.850      0.900      0.950      1.000      1.050      1.100
 R     5          1.000      1.100      1.200      1.300      1.400
 EFF   5          0.800      0.840      0.870      0.860      0.800
 R     6          1.000      1.100      1.200      1.300      1.400      1.500
 EFF   6          0.790      0.840      0.869      0.875      0.840      0.790
 R     7          1.000      1.100      1.200      1.300      1.400      1.500      1.600
 EFF   7          0.790      0.835      0.866      0.880      0.864      0.830      0.790
 R     8          1.000      1.100      1.200      1.300      1.400      1.500      1.600
                  1.700
 EFF   8          0.800      0.840      0.881      0.888      0.872      0.850      0.820
                  0.785
 EFF   8          0.805      0.842      0.880      0.885      0.878      0.860      0.835
                  0.800
 R     9          1.000      1.100      1.200      1.300      1.400      1.500      1.600
                  1.700      1.800
 EFF   9          0.815      0.850      0.880      0.885      0.878      0.864      0.844
                  0.820      0.790
 EFF   9          0.820      0.850      0.882      0.884      0.880      0.866      0.850
                  0.828      0.800
 R    10          1.000      1.100      1.200      1.300      1.400      1.500      1.600
                  1.700      1.800      1.900
 EFF  10          0.830      0.855      0.883      0.884      0.880      0.869      0.853
                  0.832      0.805      0.790
 EFF  10          0.835      0.857      0.884      0.885      0.880      0.870      0.856
                  0.840      0.815      0.795
 R    11          1.000      1.100      1.200      1.300      1.400      1.500      1.600
                  1.700      1.800      1.900      2.000
 EFF  11          0.840      0.860      0.874      0.880      0.875      0.865      0.855
                  0.840      0.820      0.798      0.790
 EFF  11          0.830      0.850      0.856      0.860      0.855      0.845      0.835
                  0.820      0.800      0.795      0.790
 EFF  11          0.810      0.817      0.820      0.820      0.810      0.800      0.797
                  0.795      0.792      0.788      0.784
 EFF  11          0.790      0.790      0.794      0.795      0.794      0.792      0.790
                  0.786      0.785      0.780      0.775
 EOT
  2116       GE21FAN1 FRONT FAN
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Listing of "*supersonic.maps*" (Continued)

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 ANGL  1       0.000
 SPED 13       0.500   0.550   0.600   0.650   0.700   0.750   0.800
               0.850   0.900   0.950   1.000   1.050   1.100
 R      5      1.000   1.100   1.200   1.300   1.400
 PR     5      1.532   1.518   1.486   1.414   1.336
 R      6      1.000   1.100   1.200   1.300   1.400   1.500
 PR     6      1.671   1.658   1.626   1.560   1.483   1.413
 R      7      1.000   1.100   1.200   1.300   1.400   1.500   1.600
 PR     7      1.828   1.816   1.785   1.719   1.639   1.565   1.502
 R      8      1.000   1.100   1.200   1.300   1.400   1.500   1.600
               1.700
 PR     8      2.029   2.014   1.975   1.900   1.810   1.734   1.663
               1.591
 PR     8      2.249   2.235   2.183   2.099   1.997   1.917   1.834
               1.759
 R      9      1.000   1.100   1.200   1.300   1.400   1.500   1.600
               1.700   1.800
 PR     9      2.467   2.444   2.391   2.299   2.184   2.100   2.013
               1.939   1.839
 PR     9      2.692   2.653   2.595   2.494   2.375   2.277   2.189
               2.103   1.996
 R     10      1.000   1.100   1.200   1.300   1.400   1.500   1.600
               1.700   1.800   1.900
 PR    10      2.941   2.898   2.816   2.705   2.566   2.454   2.365
               2.269   2.162   2.066
 PR    10      3.199   3.131   3.042   2.911   2.760   2.641   2.547
               2.444   2.330   2.235
 R     11      1.000   1.100   1.200   1.300   1.400   1.500   1.600
               1.700   1.800   1.900   2.000
 PR    11      3.443   3.366   3.255   3.109   2.953   2.824   2.730
               2.624   2.517   2.408   2.295
 PR    11      3.685   3.581   3.464   3.302   3.124   2.989   2.894
               2.786   2.675   2.568   2.450
 PR    11      3.845   3.723   3.580   3.415   3.232   3.101   3.010
               2.903   2.789   2.677   2.564
 PR    11      3.960   3.830   3.680   3.500   3.320   3.200   3.100
               3.000   2.875   2.770   2.650
EOT
 2117     GE21FAN2 CORE DRIVEN NESTED FAN
ANGL  2        1.000   2.000
SPED 13        0.500   0.550   0.600   0.650   0.700   0.750   0.8000
               0.850   0.900   0.950   1.000   1.050   1.100
R      6       1.000   1.060   1.120   1.180   1.240   1.300
FLOW   6      20.709  21.719  23.417  24.698  25.733  26.621
R      7       1.000   1.060   1.120   1.180   1.240   1.300   1.360
FLOW   7      23.753  24.418  26.043  27.226  28.261  29.271  29.914
R      8       1.000   1.060   1.120   1.180   1.240   1.300   1.360
               1.420
FLOW   8      26.575  27.412  29.110  30.170  31.279  32.167  32.858
              33.526
R      9       1.000   1.060   1.120   1.180   1.240   1.300   1.360
               1.420   1.480
FLOW   9      30.698  31.387  32.717  33.998  34.934  35.847  36.465
              37.256  37.801
R     10       1.000   1.060   1.120   1.180   1.240   1.300   1.360
               1.420   1.480   1.540
FLOW 10       34.869  35.361  36.888  38.022  38.663  39.600  40.538
              41.255  41.628  42.077
R     11       1.000   1.060   1.120   1.180   1.240   1.300   1.360
               1.420   1.480   1.540   1.600
FLOW 11       39.701  40.513  41.868  43.173  44.159  44.924  45.714
              46.382  46.952  47.253  47.381
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R      12        1.000      1.060      1.120      1.180      1.240      1.300      1.360
                 1.420      1.480      1.540      1.600      1.660
FLOW 12         46.152     47.038     48.196     49.525     50.560     51.302     52.067
                52.784     53.330     53.557     53.539     53.716
R      13        1.000      1.060      1.120      1.180      1.240      1.300      1.360
                 1.420      1.480      1.540      1.600      1.660      1.720
FLOW 13         54.735     55.891     57.245     58.477     59.488     60.302     61.043
                61.637     62.231     62.509     62.490     62.521     62.651
R      14        1.000      1.060      1.120      1.180      1.240      1.300      1.360
                 1.420      1.480      1.540      1.600      1.660      1.720      1.780
FLOW 14         66.429     67.610     68.890     70.048     71.476     72.192     73.055
                73.625     74.195     74.620     74.602     74.658     74.690     74.747
R      15        1.000      1.060      1.120      1.180      1.240      1.300      1.360
                 1.420      1.480      1.540      1.600      1.660      1.720      1.780
                 1.840
FLOW 15         78.609     79.617     80.969     82.298     83.701     84.736     85.575
                86.439     87.083     87.458     87.588     87.597     87.507     87.565
                87.565
R      16        1.000      1.060      1.120      1.180      1.240      1.300      1.360
                 1.420      1.480      1.540      1.600      1.660      1.720      1.780
                 1.840      1.900
FLOW 16         90.507     91.441     92.867     94.170     95.548     96.729     97.642
                98.678     99.371     99.821     99.929    100.035     99.971     99.956
                99.956     99.956
FLOW 16         94.591     95.893     96.902     98.107     99.535    100.447    101.432
               102.371    103.040    103.343    103.573    103.656    103.617    103.578
               103.578    103.578
FLOW 16         97.771     98.877     99.812    100.993    102.273    103.161    103.877
               104.815    105.388    105.691    105.823    105.882    105.868    105.756
               104.815    104.815
SPED 13          0.500      0.550      0.600      0.650      0.700      0.750      0.8000
                 0.850      0.900      0.950      1.000      1.050      1.100
R       5        1.000      1.100      1.200      1.300      1.400
FLOW    5       34.419     36.089     37.836     38.996     39.975
FLOW    5       37.894     39.509     41.155     42.365     43.139
R       6        1.000      1.100      1.200      1.300      1.400      1.500
FLOW    6       42.009     43.573     44.984     46.403     47.253     47.590
FLOW    6       45.970     47.349     48.815     50.257     50.877     51.037
FLOW    6       50.467     51.641     53.439     54.600     55.349     55.431
R       7        1.000      1.100      1.200      1.300      1.400      1.500      1.600
FLOW    7       55.682     57.087     58.522     60.095     60.869     61.032     61.058
R       8        1.000      1.100      1.200      1.300      1.400      1.500      1.600
                 1.700
FLOW    8       61.766     63.195     64.682     66.461     67.260     67.525     67.504
                67.408
FLOW    8       68.872     70.066     71.837     73.588     74.624     75.017     75.023
                75.059
R       9        1.000      1.100      1.200      1.300      1.400      1.500      1.600
                 1.700      1.800
FLOW    9       76.275     77.650     79.727     81.734     83.130     83.628     83.715
                83.702     83.765
FLOW    9       83.618     85.457     87.507     89.718     91.191     91.947     91.908
                91.899     91.940
R      10        1.000      1.100      1.200      1.300      1.400      1.500      1.600
                 1.700      1.800      1.900
FLOW 10         90.974     93.044     95.249     97.279     98.984     99.741     99.708
                99.651     99.719     99.608
FLOW 10         94.978     96.972     99.176    101.079    102.603    103.212    103.284
               103.203    103.274    103.163
FLOW 10         97.829     99.825    101.952    103.575    104.924    105.456    105.479
               105.451    105.422    105.390
EOT
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 2118      GE21FAN2 CORE DRIVEN NESTED FAN
ANGL  2        1.000     2.000
SPED 13        0.500     0.550     0.600     0.650     0.700     0.750     0.800
               0.850     0.900     0.950     1.000     1.050     1.100
R     6        1.000     1.060     1.120     1.180     1.240     1.300
EFF   6        0.840     0.850     0.840     0.700     0.600     0.550
R     7        1.000     1.060     1.120     1.180     1.240     1.300     1.360
EFF   7        0.840     0.855     0.855     0.810     0.680     0.600     0.550
R     8        1.000     1.060     1.120     1.180     1.240     1.300     1.360
               1.420
EFF   8        0.840     0.850     0.860     0.840     0.770     0.650     0.600
               0.550
R     9        1.000     1.060     1.120     1.180     1.240     1.300     1.360
               1.420     1.480
EFF   9        0.840     0.849     0.860     0.855     0.830     0.760     0.650
               0.600     0.550
R    10        1.000     1.060     1.120     1.180     1.240     1.300     1.360
               1.420     1.480     1.540
EFF  10        0.840     0.848     0.860     0.860     0.850     0.800     0.750
               0.650     0.600     0.550
R    11        1.000     1.060     1.120     1.180     1.240     1.300     1.360
               1.420     1.480     1.540     1.600
EFF  11        0.838     0.846     0.858     0.865     0.860     0.840     0.810
               0.760     0.680     0.600     0.550
R    12        1.000     1.060     1.120     1.180     1.240     1.300     1.360
               1.420     1.480     1.540     1.600     1.660
EFF  12        0.836     0.845     0.855     0.862     0.865     0.860     0.845
               0.820     0.790     0.680     0.600     0.550
R    13        1.000     1.060     1.120     1.180     1.240     1.300     1.360
               1.420     1.480     1.540     1.600     1.660     1.720
EFF  13        0.831     0.842     0.853     0.860     0.863     0.865     0.860
               0.850     0.840     0.800     0.730     0.670     0.600
R    14        1.000     1.060     1.120     1.180     1.240     1.300     1.360
               1.420     1.480     1.540     1.600     1.660     1.720     1.780
EFF  14        0.820     0.830     0.840     0.852     0.860     0.865     0.870
               0.865     0.856     0.840     0.815     0.780     0.730     0.660
R    15        1.000     1.060     1.120     1.180     1.240     1.300     1.360
               1.420     1.480     1.540     1.600     1.660     1.720     1.780
               1.840
EFF  15        0.802     0.806     0.814     0.828     0.840     0.850     0.855
               0.860     0.860     0.856     0.840     0.820     0.790     0.750
               0.700
R    16        1.000     1.060     1.120     1.180     1.240     1.300     1.360
               1.420     1.480     1.540     1.600     1.660     1.720     1.780
               1.840     1.900
EFF  16        0.785     0.790     0.795     0.802     0.808     0.816     0.824
               0.830     0.834     0.832     0.824     0.810     0.801     0.770
               0.740     0.695
EFF  16        0.770     0.780     0.792     0.797     0.802     0.806     0.811
               0.817     0.820     0.820     0.810     0.805     0.780     0.760
               0.740     0.700
EFF  16        0.740     0.750     0.760     0.770     0.780     0.790     0.790
               0.794     0.795     0.796     0.790     0.780     0.770     0.750
               0.730     0.680
SPED 13        0.500     0.550     0.600     0.650     0.700     0.750     0.800
               0.850     0.900     0.950     1.000     1.050     1.100
R     5        1.000     1.100     1.200     1.300     1.400
EFF   5        0.845     0.844     0.790     0.600     0.500
EFF   5        0.845     0.850     0.810     0.680     0.520
R     6        1.000     1.100     1.200     1.300     1.400     1.500
EFF   6        0.845     0.855     0.835     0.760     0.620     0.490
EFF   6        0.845     0.855     0.845     0.810     0.690     0.530
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EFF   6      0.844    0.852    0.852    0.826    0.760    0.630
R     7      1.000    1.100    1.200    1.300    1.400    1.500    1.600
EFF   7      0.843    0.850    0.855    0.844    0.815    0.700    0.630
R     8      1.000    1.100    1.200    1.300    1.400    1.500    1.600
             1.700
EFF   8      0.835    0.844    0.853    0.852    0.830    0.780    0.700
             0.620
EFF   8      0.825    0.835    0.850    0.855    0.849    0.820    0.760
             0.680
R     9      1.000    1.100    1.200    1.300    1.400    1.500    1.600
             1.700    1.800
EFF   9      0.805    0.820    0.835    0.850    0.852    0.835    0.810
             0.750    0.650
EFF   9      0.770    0.809    0.819    0.835    0.844    0.834    0.810
             0.770    0.710
R    10      1.000    1.100    1.200    1.300    1.400    1.500    1.600
             1.700    1.800    1.900
EFF  10      0.700    0.750    0.805    0.822    0.823    0.820    0.810
             0.770    0.725    0.670
EFF  10      0.700    0.740    0.780    0.810    0.820    0.815    0.800
             0.760    0.720    0.670
EFF  10      0.700    0.720    0.750    0.780    0.800    0.800    0.775
             0.750    0.710    0.650
EOT
 2119     GE21FAN2 CORE DRIVEN NESTED FAN
ANGL  2      1.000    2.000
SPED 13      0.500    0.550    0.600    0.650    0.700    0.750    0.800
             0.850    0.900    0.950    1.000    1.050    1.100
R     6      1.000    1.060    1.120    1.180    1.240    1.300
PR    6      1.061    1.047    1.032    1.018    1.005    0.984
R     7      1.000    1.060    1.120    1.180    1.240    1.300    1.360
PR    7      1.075    1.066    1.049    1.030    1.018    1.002    0.983
R     8      1.000    1.060    1.120    1.180    1.240    1.300    1.360
             1.420
PR    8      1.091    1.083    1.069    1.051    1.037    1.021    1.003
             0.979
R     9      1.000    1.060    1.120    1.180    1.240    1.300    1.360
             1.420    1.480
PR    9      1.116    1.108    1.093    1.078    1.064    1.044    1.026
             1.005    0.984
R    10      1.000    1.060    1.120    1.180    1.240    1.300    1.360
             1.420    1.480    1.540
PR   10      1.145    1.139    1.124    1.105    1.091    1.076    1.056
             1.033    1.011    0.980
R    11      1.000    1.060    1.120    1.180    1.240    1.300    1.360
             1.420    1.480    1.540    1.600
PR   11      1.186    1.179    1.162    1.146    1.134    1.115    1.095
             1.074    1.049    1.021    0.994
R    12      1.000    1.060    1.120    1.180    1.240    1.300    1.360
             1.420    1.480    1.540    1.600    1.660
PR   12      1.237    1.231    1.215    1.202    1.188    1.167    1.148
             1.126    1.100    1.072    1.039    1.013
R    13      1.000    1.060    1.120    1.180    1.240    1.300    1.360
             1.420    1.480    1.540    1.600    1.660    1.720
PR   13      1.321    1.313    1.300    1.282    1.268    1.252    1.229
             1.210    1.189    1.152    1.124    1.090    1.053
R    14      1.000    1.060    1.120    1.180    1.240    1.300    1.360
             1.420    1.480    1.540    1.600    1.660    1.720    1.780
PR   14      1.447    1.440    1.430    1.415    1.399    1.384    1.366
             1.342    1.315    1.282    1.251    1.217    1.179    1.140
R    15      1.000    1.060    1.120    1.180    1.240    1.300    1.360
             1.420    1.480    1.540    1.600    1.660    1.720    1.780
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Listing of "*supersonic.maps*" (Continued)

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               1.840
PR    15       1.606     1.602     1.597     1.585     1.573     1.560     1.543
               1.520     1.496     1.462     1.427     1.385     1.342     1.301
               1.260
R     16       1.000     1.060     1.120     1.180     1.240     1.300     1.360
               1.420     1.480     1.540     1.600     1.660     1.720     1.780
               1.840     1.900
PR    16       1.815     1.815     1.813     1.804     1.796     1.788     1.771
               1.749     1.722     1.687     1.638     1.601     1.552     1.503
               1.425     1.390
PR    16       1.909     1.910     1.905     1.898     1.887     1.872     1.858
               1.834     1.803     1.763     1.719     1.675     1.623     1.573
               1.520     1.460
PR    16       1.981     1.979     1.974     1.965     1.951     1.935     1.919
               1.895     1.860     1.819     1.773     1.726     1.673     1.617
               1.570     1.500
SPED 13        0.500     0.550     0.600     0.650     0.700     0.750     0.800
               0.850     0.900     0.950     1.000     1.050     1.100
R      5       1.000     1.100     1.200     1.300     1.400
PR     5       1.112     1.083     1.056     1.015     0.974
PR     5       1.134     1.111     1.079     1.042     0.999
R      6       1.000     1.100     1.200     1.300     1.400     1.500
PR     6       1.166     1.142     1.115     1.073     1.033     0.986
PR     6       1.197     1.180     1.147     1.110     1.066     1.012
PR     6       1.238     1.218     1.192     1.151     1.106     1.053
R      7       1.000     1.100     1.200     1.300     1.400     1.500     1.600
PR     7       1.289     1.272     1.248     1.208     1.165     1.107     1.061
R      8       1.000     1.100     1.200     1.300     1.400     1.500     1.600
               1.700
PR     8       1.357     1.343     1.319     1.280     1.238     1.181     1.129
               1.071
PR     8       1.444     1.435     1.409     1.375     1.326     1.271     1.215
               1.154
R      9       1.000     1.100     1.200     1.300     1.400     1.500     1.600
               1.700     1.800
PR     9       1.554     1.544     1.526     1.495     1.449     1.392     1.330
               1.264     1.199
PR     9       1.677     1.670     1.653     1.628     1.582     1.526     1.459
               1.385     1.315
R     10       1.000     1.100     1.200     1.300     1.400     1.500     1.600
               1.700     1.800     1.900
PR    10       1.823     1.818     1.802     1.778     1.733     1.674     1.598
               1.517     1.443     1.368
PR    10       1.914     1.906     1.893     1.863     1.818     1.748     1.668
               1.584     1.506     1.430
PR    10       1.989     1.976     1.961     1.924     1.870     1.799     1.713
               1.628     1.545     1.466
EOT
 2120       GE21HPC NESTED HPC
ANGL  2        1.00      2.00
SPED 13        0.500     0.550     0.600     0.650     0.700     0.750     0.800
               0.850     0.900     0.950     1.000     1.050     1.100
R      3       1.000     1.100     1.200
FLOW   3      21.002    23.396    24.856
FLOW   3      23.923    26.145    27.802
R      4       1.000     1.100     1.200     1.300
FLOW   4      27.211    29.459    30.993    31.891
FLOW   4      31.164    33.386    34.946    36.016
R      5       1.000     1.100     1.200     1.300     1.400
FLOW   5      35.436    37.412    39.094    40.041    40.499
FLOW   5      40.245    42.640    44.249    45.417    45.972
R      6       1.000     1.100     1.200     1.300     1.400     1.500
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FLOW  6      46.973    49.145    50.754    52.020    52.625    52.741
R     7       1.000     1.100     1.200     1.300     1.400     1.500     1.600
FLOW  7      55.342    57.761    59.442    60.979    61.706    61.945    61.890
R     8       1.000     1.100     1.200     1.300     1.400     1.500     1.600
              1.700
FLOW  8      67.565    69.834    71.665    73.250    74.076    74.462    74.358
             74.424
R    10       1.000     1.100     1.200     1.300     1.400     1.500     1.600
              1.700     1.800     1.900
FLOW 10      79.442    81.982    84.008    85.691    86.786    87.590    87.758
             87.751    87.770    87.791
R    11       1.000     1.100     1.200     1.300     1.400     1.500     1.600
              1.700     1.800     1.900     2.000
FLOW 11      93.376    95.374    97.425    98.592    99.688   100.320   100.464
            100.532   100.477   100.476   100.471
FLOW 11      99.066   100.352   101.764   102.884   103.586   103.949   104.044
            103.940   104.009   104.034   104.004
FLOW 11     102.034   103.294   104.339   105.139   105.793   106.107   106.104
            106.124   106.119   106.142   106.040
SPED 13       0.500     0.550     0.600     0.650     0.700     0.750     0.800
              0.850     0.900     0.950     1.000     1.050     1.100
R     3       1.000     1.100     1.200
FLOW  3      37.074    37.535    37.890
FLOW  3      40.642    41.161    41.487
R     4       1.000     1.100     1.200     1.300
FLOW  4      45.044    45.445    45.771    45.950
FLOW  4      49.153    49.612    49.910    50.028
R     5       1.000     1.100     1.200     1.300     1.400
FLOW  5      54.067    54.382    54.707    54.753    54.695
R     6       1.000     1.100     1.200     1.300     1.400     1.500
FLOW  6      59.759    60.059    60.384    60.577    60.518    60.606
R     7       1.000     1.100     1.200     1.300     1.400     1.500     1.600
FLOW  7      66.289    66.823    67.205    67.369    67.397    67.396    67.411
R     8       1.000     1.100     1.200     1.300     1.400     1.500     1.600
              1.700
FLOW  8      73.437    74.072    74.661    74.998    75.071    75.142    75.125
             75.152
R     9       1.000     1.100     1.200     1.300     1.400     1.500     1.600
              1.700     1.800
FLOW  9      80.735    81.518    82.400    83.308    83.775    83.934    83.902
             83.869    83.893
R    10       1.000     1.100     1.200     1.300     1.400     1.500     1.600
              1.700     1.800     1.900
FLOW 10      87.745    88.602    89.704    90.847    91.754    92.307    92.493
             92.460    92.484    92.477
R    11       1.000     1.100     1.200     1.300     1.400     1.500     1.600
              1.700     1.800     1.900     2.000
FLOW 11      95.140    96.011    97.259    98.417    99.455   100.081   100.370
            100.410   100.460   100.439   100.412
FLOW 11      99.396   100.063   101.119   102.233   103.182   103.676   103.891
            103.902   103.922   103.945   103.976
FLOW 11     101.804   102.470   103.513   104.465   105.296   105.775   105.960
            105.986   106.005   106.014   106.043
EOT
 2121      GE21HPC NESTED HPC
ANGL  2       1.00      2.00
SPED 13       0.500     0.550     0.600     0.650     0.700     0.750     0.800
              0.850     0.900     0.950     1.000     1.050     1.100
R     3       1.000     1.100     1.200
EFF   3       0.820     0.820     0.740
EFF   3       0.830     0.836     0.790
R     4       1.000     1.100     1.200     1.300
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EFF   4      0.840    0.848    0.820    0.740
EFF   4      0.840    0.853    0.845    0.750
R     5      1.000    1.100    1.200    1.300    1.400
EFF   5      0.840    0.856    0.853    0.810    0.730
EFF   5      0.840    0.856    0.861    0.845    0.760
R     6      1.000    1.100    1.200    1.300    1.400    1.500
EFF   6      0.840    0.857    0.867    0.861    0.820    0.740
R     7      1.000    1.100    1.200    1.300    1.400    1.500    1.600
EFF   7      0.840    0.860    0.870    0.872    0.860    0.810    0.735
R     8      1.000    1.100    1.200    1.300    1.400    1.500    1.600
             1.700
EFF   8      0.840    0.860    0.872    0.878    0.875    0.854    0.805
             0.750
R    10      1.000    1.100    1.200    1.300    1.400    1.500    1.600
             1.700    1.800    1.900
EFF  10      0.835    0.853    0.866    0.874    0.874    0.870    0.840
             0.800    0.750    0.690
R    11      1.000    1.100    1.200    1.300    1.400    1.500    1.600
             1.700    1.800    1.900    2.000
EFF  11      0.836    0.847    0.857    0.860    0.860    0.860    0.835
             0.810    0.760    0.720    0.670
EFF  11      0.813    0.817    0.820    0.820    0.820    0.810    0.790
             0.770    0.730    0.680    0.650
EFF  11      0.800    0.800    0.800    0.800    0.800    0.790    0.775
             0.750    0.720    0.680    0.650
SPED 13      0.500    0.550    0.600    0.650    0.700    0.750    0.800
             0.850    0.900    0.950    1.000    1.050    1.100
R     3      1.000    1.100    1.200
EFF   3      0.840    0.800    0.770
EFF   3      0.845    0.820    0.770
R     4      1.000    1.100    1.200    1.300
EFF   4      0.855    0.830    0.780    0.760
EFF   4      0.860    0.840    0.790    0.770
R     5      1.000    1.100    1.200    1.300    1.400
EFF   5      0.865    0.855    0.826    0.780    0.760
R     6      1.000    1.100    1.200    1.300    1.400    1.500
EFF   6      0.871    0.870    0.850    0.815    0.770    0.755
R     7      1.000    1.100    1.200    1.300    1.400    1.500    1.600
EFF   7      0.874    0.874    0.870    0.855    0.790    0.770    0.750
R     8      1.000    1.100    1.200    1.300    1.400    1.500    1.600
             1.700
EFF   8      0.877    0.879    0.878    0.870    0.840    0.790    0.770
             0.755
R     9      1.000    1.100    1.200    1.300    1.400    1.500    1.600
             1.700    1.800
EFF   9      0.870    0.873    0.875    0.873    0.870    0.850    0.810
             0.780    0.760
R    10      1.000    1.100    1.200    1.300    1.400    1.500    1.600
             1.700    1.800    1.900
EFF  10      0.860    0.864    0.870    0.871    0.871    0.865    0.845
             0.815    0.780    0.760
R    11      1.000    1.100    1.200    1.300    1.400    1.500    1.600
             1.700    1.800    1.900    2.000
EFF  11      0.845    0.850    0.856    0.860    0.862    0.860    0.845
             0.826    0.789    0.772    0.750
EFF  11      0.815    0.816    0.820    0.823    0.823    0.820    0.800
             0.785    0.772    0.760    0.740
EFF  11      0.780    0.790    0.790    0.790    0.790    0.790    0.782
             0.780    0.770    0.758    0.735
EOT
 2122     GE21HPC NESTED HPC
ANGL  2      1.00     2.00
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Listing of "*supersonic.maps*" (Continued)

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SPED 13   0.500   0.550   0.600   0.650   0.700   0.750   0.800
          0.850   0.900   0.950   1.000   1.050   1.100
R     3   1.000   1.100   1.200
PR    3   1.881   1.699   1.469
PR    3   2.202   2.010   1.761
R     4   1.000   1.100   1.200   1.300
PR    4   2.584   2.345   2.096   1.718
PR    4   2.977   2.771   2.498   2.120
R     5   1.000   1.100   1.200   1.300   1.400
PR    5   3.408   3.197   2.924   2.565   2.083
PR    5   3.962   3.752   3.465   3.116   2.662
R     6   1.000   1.100   1.200   1.300   1.400   1.500
PR    6   4.619   4.422   4.154   3.829   3.346   2.759
R     7   1.000   1.100   1.200   1.300   1.400   1.500   1.600
PR    7   5.551   5.336   5.106   4.781   4.327   3.764   3.115
R     8   1.000   1.100   1.200   1.300   1.400   1.500   1.600
          1.700
PR    8   6.872   6.728   6.455   6.149   5.705   5.141   4.497
          3.939
R    10   1.000   1.100   1.200   1.300   1.400   1.500   1.600
          1.700   1.800   1.900
PR   10   8.220   8.100   7.875   7.574   7.187   6.657   6.004
          5.398   4.773   4.072
R    11   1.000   1.100   1.200   1.300   1.400   1.500   1.600
          1.700   1.800   1.900   2.000
PR   11   9.997   9.877   9.628   9.293   8.892   8.343   7.647
          7.022   6.373   5.582   4.933
PR   11  10.742  10.573  10.262   9.890   9.440   8.849   8.153
          7.509   6.832   5.998   5.364
PR   11  11.129  10.989  10.611  10.214   9.770   9.159   8.416
          7.757   7.099   6.318   5.626
SPED 13   0.500   0.550   0.600   0.650   0.700   0.750   0.800
          0.850   0.900   0.950   1.000   1.050   1.100
R     3   1.000   1.100   1.200
PR    3   2.550   2.371   2.094
PR    3   2.841   2.656   2.385
R     4   1.000   1.100   1.200   1.300
PR    4   3.237   3.006   2.707   2.397
PR    4   3.582   3.340   3.069   2.685
R     5   1.000   1.100   1.200   1.300   1.400
PR    5   4.016   3.819   3.497   3.142   2.690
R     6   1.000   1.100   1.200   1.300   1.400   1.500
PR    6   4.576   4.403   4.081   3.748   3.279   2.832
R     7   1.000   1.100   1.200   1.300   1.400   1.500   1.600
PR    7   5.396   5.205   4.871   4.521   4.029   3.554   3.119
R     8   1.000   1.100   1.200   1.300   1.400   1.500   1.600
          1.700
PR    8   6.356   6.141   5.886   5.473   5.043   4.533   4.018
          3.480
R     9   1.000   1.100   1.200   1.300   1.400   1.500   1.600
          1.700   1.800
PR    9   7.452   7.311   7.072   6.747   6.321   5.822   5.279
          4.713   4.129
R    10   1.000   1.100   1.200   1.300   1.400   1.500   1.600
          1.700   1.800   1.900
PR   10   8.653   8.546   8.346   8.082   7.706   7.240   6.672
          6.123   5.493   4.835
R    11   1.000   1.100   1.200   1.300   1.400   1.500   1.600
          1.700   1.800   1.900   2.000
PR   11  10.029   9.911   9.721   9.463   9.075   8.625   8.069
          7.519   6.827   6.191   5.356
PR   11  10.843  10.726  10.480  10.194   9.794   9.288   8.715
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Listing of "*supersonic.maps*" (Continued)

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             8.171    7.444    6.798    5.973
PR    11    11.346   11.194   10.983   10.675   10.236    9.695    9.105
             8.590    7.829    7.216    6.306
EOT
 3501     FLADE TIP MOUNTED FAN
ANGL  5      -5.0      0.0     50.0     65.0     85.0
SPED  2      0.95     1.00
R     8       1.0      1.2      1.4      1.6      1.7      1.8      1.9
              2.0
FLOW  8      272.     300.     318.     330.     336.     338.    339.5
             340.
FLOW  8      304.     321.     339.     346.     349.     351.     353.
             354.
SPED 12      0.40     0.50     0.60     0.70     0.75     0.80     0.85
             0.90     0.95     1.00     1.05     1.10
R     6       1.0      1.1      1.2      1.3      1.4      1.5
FLOW  6       84.     118.     127.     134.     141.     147.
R     7       1.0      1.1      1.2      1.3      1.4      1.5      1.6
FLOW  7      106.     132.     143.     152.     159.     165.     172.
R     9       1.0      1.1      1.2      1.3      1.4      1.5      1.6
              1.7      1.8
FLOW  9      129.     148.     159.     168.     178.     185.     191.
             196.     200.
R    10       1.0      1.1      1.2      1.3      1.4      1.5      1.6
              1.7      1.8      1.9
FLOW 10      156.     167.     180.     190.     199.     206.     212.
             216.     219.     221.
FLOW 10      170.     179.     191.     202.     210.     217.     223.
             227.     229.     230.
FLOW 10      184.     191.     204.     214.     222.     228.     234.
             237.     239.    239.5
FLOW 10      199.     204.     217.     227.     235.     241.     246.
             248.    248.5    248.5
FLOW 10      212.     217.     232.     241.     248.     253.     256.
             258.     258.     258.
FLOW 10      226.     235.     248.     256.     262.     266.     268.
            268.5    268.5    268.5
FLOW 10      240.     252.     264.     272.     276.     278.     279.
             279.     279.     279.
FLOW 10      252.     267.     279.     284.     287.     288.     288.
             288.     288.     288.
FLOW 10      260.     282.     291.     294.    295.5    295.5    295.5
            295.5    295.5    295.5
SPED 12      0.40     0.50     0.60     0.70     0.75     0.80     0.85
             0.90     0.95     1.00     1.05     1.10
R     4       1.0      1.1      1.2      1.3
FLOW  4       59.     67.5      72.     75.5
R     6       1.0      1.1      1.2      1.3      1.4      1.5
FLOW  6      74.5      80.     84.5     88.7      92.     94.5
R     7       1.0      1.1      1.2      1.3      1.4      1.5      1.6
FLOW  7       88.      93.      98.    102.5     106.    108.5    110.5
R     8       1.0      1.1      1.2      1.3      1.4      1.5      1.6
              1.7
FLOW  8      103.     109.    113.5     118.     121.     123.     125.
             127.
R     9       1.0      1.1      1.2      1.3      1.4      1.5      1.6
              1.7      1.8
FLOW  9      111.     117.    121.5    125.5    128.5     131.    132.5
             134.     136.
FLOW  9      117.    125.5    129.5     133.     136.     138.     140.
            141.5     143.
FLOW  9      124.    133.5    137.5     141.     144.    145.5     147.
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             148.7     150.
FLOW   9     130.      141.5     145.5     149.      151.5     153.      154.5
             156.      157.
FLOW   9     140.      149.      153.5     157.      159.5     161.      162.5
             163.5     164.5
R     10       1.0       1.1       1.2       1.3       1.4       1.5       1.6
               1.7       1.8       1.9
FLOW  10     149.5     157.5     162.      165.5     167.5     169.      170.
             171.      172.      173.
FLOW  10     160.      166.      170.      173.      175.      176.5     177.3
             178.      178.5     179.
FLOW  10     166.      173.5     177.5     180.      181.5     182.5     183.
             183.5     184.      184.2
SPED  12       0.40      0.50      0.60      0.70      0.75      0.80      0.85
               0.90      0.95      1.00      1.05      1.10
R      7       1.0       1.1       1.2       1.3       1.4       1.5       1.6
FLOW   7      45.       48.       49.5      51.3      52.       52.3      52.6
R      8       1.0       1.1       1.2       1.3       1.4       1.5       1.6
               1.7
FLOW   8      57.       58.       60.       61.5      62.       63.       63.3
              64.5
R      9       1.0       1.1       1.2       1.3       1.4       1.5       1.6
               1.7       1.8
FLOW   9      68.       68.7      70.2      71.5      72.3      73.       74.
              75.       76.
R     10       1.0       1.1       1.2       1.3       1.4       1.5       1.6
               1.7       1.8       1.9
FLOW  10      78.7      79.       80.5      81.5      82.7      83.2      84.
              85.       86.       87.
FLOW  10      84.       84.5      86.       86.7      87.7      88.2      89.
              90.       91.       92.
FLOW  10      89.       89.8      91.       92.       92.6      93.5      94.
              95.       96.       96.5
FLOW  10      94.       95.       96.       97.       97.5      98.5      99.
              99.8     100.5     101.3
FLOW  10      99.      100.3     101.2     102.      103.      103.5     104.
             104.7     105.3     106.
FLOW  10     104.      106.      107.      107.5     108.      108.8     109.
             110.      110.5     111.
FLOW  10     109.5     111.3     112.      112.8     113.3     114.      114.5
             115.      115.5     116.
FLOW  10     114.5     116.5     117.2     117.8     118.2     118.8     119.
             119.3     119.8     120.
FLOW  10     119.      121.      121.5     122.      122.1     122.5     122.9
             123.      123.1     123.3
SPED  12       0.40      0.50      0.60      0.70      0.75      0.80      0.85
               0.90      0.95      1.00      1.05      1.10
R     10       1.0       1.1       1.2       1.3       1.4       1.5       1.6
               1.7       1.8       1.9
FLOW  10      12.15     12.18     12.20     12.21     12.23     12.25     12.27
              12.30     12.32     12.35
FLOW  10      14.68     14.69     14.70     14.72     14.75     14.77     14.79
              14.80     14.81     14.82
FLOW  10      16.82     16.83     16.84     16.85     16.88     16.89     16.90
              16.91     16.92     16.93
FLOW  10      18.65     18.67     18.69     18.70     18.70     18.70     18.71
              18.72     18.74     18.75
FLOW  10      19.53     19.54     19.55     19.56     19.58     19.59     19.60
              19.60     19.60     19.61
FLOW  10      20.32     20.33     20.34     20.34     20.35     20.37     20.38
              20.39     20.40     20.40
FLOW  10      21.25     21.25     21.26     21.28     21.29     21.30     21.30
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               21.30     21.30     21.31
 FLOW 10       22.10     22.10     22.10     22.10     22.10     22.11     22.11
               22.12     22.13     22.14
 FLOW 10       23.30     23.30     23.30     23.30     23.30     23.31     23.31
               23.31     23.31     23.32
 FLOW 10       24.40     24.40     24.40     24.40     24.40     24.40     24.40
               24.41     24.41     24.41
 FLOW 10       25.18     25.18     25.18     25.18     25.18     25.18     25.18
               25.19     25.19     25.19
 FLOW 10       25.30     25.30     25.30     25.30     25.30     25.30     25.30
               25.30     25.30     25.30
EOT
 3502     FLADE TIP MOUNTED FAN
ANGL  5         -5.0       0.0      50.0      65.0      85.0
SPED  2         0.95      1.00
R     8          1.0       1.2       1.4       1.6       1.7       1.8       1.9
                 2.0
EFF   8         .725      .825      .870      .891      .880      .850      .840
                .835
EFF   8         .880      .891      .890      .860      .850      .835      .825
                .800
SPED 12         0.40      0.50      0.60      0.70      0.75      0.80      0.85
                0.90      0.95      1.00      1.05      1.10
R     6          1.0       1.1       1.2       1.3       1.4       1.5
EFF   6         .690      .810      .790      .710      .590      .500
R     7          1.0       1.1       1.2       1.3       1.4       1.5       1.6
EFF   7         .690      .805      .845      .848      .800      .720      .580
R     9          1.0       1.1       1.2       1.3       1.4       1.5       1.6
                 1.7       1.8
EFF   9         .700      .790      .835      .860      .862      .840      .760
                .620      .500
R    10          1.0       1.1       1.2       1.3       1.4       1.5       1.6
                 1.7       1.8       1.9
EFF  10         .730      .780      .830      .862      .883      .870      .835
                .760      .640      .510
EFF  10         .750      .785      .833      .864      .882      .880      .850
                .799      .699      .570
EFF  10         .770      .790      .838      .870      .885      .885      .860
                .810      .720      .600
EFF  10         .780      .800      .842      .872      .887      .885      .862
                .817      .730      .599
EFF  10         .785      .801      .847      .872      .888      .885      .860
                .818      .720      .590
EFF  10         .780      .808      .850      .873      .883      .876      .850
                .800      .680      .560
EFF  10         .765      .805      .848      .869      .872      .861      .825
                .745      .630      .520
EFF  10         .747      .800      .840      .853      .852      .833      .750
                .685      .595      .480
EFF  10         .710      .775      .810      .820      .813      .750      .685
                .610      .530      .450
SPED 12         0.40      0.50      0.60      0.70      0.75      0.80      0.85
                0.90      0.95      1.00      1.05      1.10
R     4          1.0       1.1       1.2       1.3
EFF   4         .400      .451      .430      .350
R     6          1.0       1.1       1.2       1.3       1.4       1.5
EFF   6         .400      .449      .463      .447      .390      .300
R     7          1.0       1.1       1.2       1.3       1.4       1.5       1.6
EFF   7         .400      .445      .472      .474      .452      .410      .355
R     8          1.0       1.1       1.2       1.3       1.4       1.5       1.6
                 1.7
EFF   8         .410      .450      .470      .475      .460      .435      .398
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                .330
R      9        1.0     1.1     1.2     1.3     1.4     1.5     1.6
                1.7     1.8
EFF    9        .415    .453    .471    .477    .460    .440    .408
                .355    .285
EFF    9        .415    .455    .472    .478    .462    .445    .417
                .375    .310
EFF    9        .400    .455    .469    .476    .463    .447    .423
                .385    .337
EFF    9        .380    .452    .466    .472    .462    .449    .425
                .395    .350
EFF    9        .370    .442    .460    .464    .460    .448    .428
                .400    .360
R      10       1.0     1.1     1.2     1.3     1.4     1.5     1.6
                1.7     1.8     1.9
EFF    10       .350    .432    .450    .456    .452    .442    .423
                .398    .360    .300
EFF    10       .350    .419    .440    .447    .443    .435    .417
                .393    .358    .300
EFF    10       .350    .407    .428    .435    .432    .424    .407
                .380    .354    .300
SPED 12         0.40    0.50    0.60    0.70    0.75    0.80    0.85
                0.90    0.95    1.00    1.05    1.10
R      7        1.0     1.1     1.2     1.3     1.4     1.5     1.6
EFF    7        .435    .440    .399    .300    .250    .210    .190
R      8        1.0     1.1     1.2     1.3     1.4     1.5     1.6
                1.7
EFF    8        .430    .430    .425    .398    .363    .325    .300
                .200
R      9        1.0     1.1     1.2     1.3     1.4     1.5     1.6
                1.7     1.8
EFF    9        .442    .443    .439    .421    .402    .375    .350
                .285    .160
R      10       1.0     1.1     1.2     1.3     1.4     1.5     1.6
                1.7     1.8     1.9
EFF    10       .451    .452    .448    .439    .420    .400    .376
                .322    .230    .130
EFF    10       .456    .456    .451    .442    .409    .407    .385
                .337    .250    .140
EFF    10       .460    .461    .456    .449    .435    .415    .393
                .349    .275    .165
EFF    10       .461    .467    .460    .452    .440    .420    .400
                .356    .295    .210
EFF    10       .462    .470    .461    .455    .442    .423    .403
                .367    .300    .235
EFF    10       .458    .462    .460    .453    .442    .424    .405
                .375    .313    .240
EFF    10       .448    .455    .451    .446    .436    .418    .399
                .370    .310    .245
EFF    10       .440    .447    .446    .441    .430    .412    .396
                .365    .306    .245
EFF    10       .440    .450    .445    .440    .418    .410    .393
                .358    .307    .250
SPED 12         0.40    0.50    0.60    0.70    0.75    0.80    0.85
                0.90    0.95    1.00    1.05    1.10
R      10       1.0     1.1     1.2     1.3     1.4     1.5     1.6
                1.7     1.8     1.9
EFF    10       .410    .400    .355    .335    .285    .260    .235
                .195    .153    .100
EFF    10       .410    .400    .365    .342    .292    .260    .236
                .195    .152    .100
EFF    10       .410    .400    .370    .350    .305    .260    .236
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Listing of "*supersonic.maps*" (Continued)

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              .195      .151      .100
EFF   10      .410      .400      .373      .350      .310      .261      .236
              .195      .150      .100
EFF   10      .410      .400      .378      .351      .310      .262      .236
              .195      .150      .100
EFF   10      .410      .400      .382      .353      .313      .263      .236
              .195      .149      .100
EFF   10      .410      .400      .383      .354      .315      .263      .236
              .195      .149      .100
EFF   10      .410      .400      .385      .354      .316      .264      .237
              .195      .149      .100
EFF   10      .411      .400      .386      .355      .318      .264      .237
              .195      .149      .100
EFF   10      .411      .400      .387      .356      .320      .265      .237
              .195      .149      .100
EFF   10      .411      .400      .388      .357      .322      .267      .237
              .195      .149      .100
EFF   10      .412      .400      .389      .359      .325      .268      .238
              .195      .149      .100
EOT
 3503     FLADE TIP MOUNTED FAN
ANGL  5      -5.00       0.0      50.0      65.0      85.0
SPED  2       0.95      1.00
R     8        1.0       1.2       1.4       1.6       1.7       1.8       1.9
               2.0
PR    8      1.490     1.498     1.491     1.461     1.438     1.412     1.380
             1.341
PR    8      1.580     1.585     1.570     1.520     1.478     1.451     1.415
             1.378
SPED 12       0.40      0.50      0.60      0.70      0.75      0.80      0.85
              0.90      0.95      1.00      1.05      1.10
R     6        1.0       1.1       1.2       1.3       1.4       1.5
PR    6      1.080     1.075     1.065     1.052     1.037     1.013
R     7        1.0       1.1       1.2       1.3       1.4       1.5       1.6
PR    7      1.125     1.125     1.120     1.109     1.093     1.073     1.046
R     9        1.0       1.1       1.2       1.3       1.4       1.5       1.6
               1.7       1.8
PR    9      1.180     1.183     1.180     1.170     1.156     1.137     1.110
             1.080     1.046
R    10        1.0       1.1       1.2       1.3       1.4       1.5       1.6
               1.7       1.8       1.9
PR   10      1.252     1.255     1.252     1.242     1.228     1.206     1.176
             1.145     1.108     1.075
PR   10      1.295     1.296     1.292     1.280     1.267     1.243     1.212
             1.180     1.138     1.100
PR   10      1.340     1.340     1.335     1.325     1.307     1.280     1.248
             1.210     1.166     1.125
PR   10      1.388     1.388     1.382     1.370     1.350     1.322     1.283
             1.245     1.195     1.150
PR   10      1.440     1.440     1.430     1.415     1.392     1.362     1.320
             1.280     1.226     1.175
PR   10      1.498     1.498     1.488     1.470     1.440     1.402     1.360
             1.315     1.260     1.210
PR   10      1.560     1.560     1.545     1.522     1.488     1.444     1.396
             1.350     1.296     1.238
PR   10      1.618     1.620     1.600     1.568     1.527     1.478     1.427
             1.378     1.325     1.265
PR   10      1.665     1.672     1.642     1.600     1.553     1.500     1.450
             1.400     1.346     1.285
SPED 12       0.40      0.50      0.60      0.70      0.75      0.80      0.85
              0.90      0.95      1.00      1.05      1.10
R     4        1.0       1.1       1.2       1.3
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PR     4      1.038     1.035     1.027     1.019
R      6        1.0       1.1       1.2       1.3       1.4       1.5
PR     6      1.060     1.057     1.053     1.044     1.033     1.022
R      7        1.0       1.1       1.2       1.3       1.4       1.5       1.6
PR     7      1.085     1.083     1.077     1.068     1.058     1.046     1.036
R      8        1.0       1.1       1.2       1.3       1.4       1.5       1.6
                1.7
PR     8      1.118     1.115     1.108     1.098     1.085     1.073     1.060
              1.045
R      9        1.0       1.1       1.2       1.3       1.4       1.5       1.6
                1.7       1.8
PR     9      1.135     1.132     1.124     1.113     1.097     1.086     1.074
              1.057     1.042
PR     9      1.153     1.148     1.138     1.126     1.113     1.100     1.086
              1.070     1.053
PR     9      1.168     1.163     1.155     1.140     1.127     1.114     1.100
              1.083     1.065
PR     9      1.184     1.180     1.169     1.155     1.140     1.127     1.113
              1.096     1.078
PR     9      1.194     1.195     1.185     1.170     1.155     1.140     1.127
              1.108     1.090
R     10        1.0       1.1       1.2       1.3       1.4       1.5       1.6
                1.7       1.8       1.9
PR    10      1.213     1.212     1.203     1.186     1.170     1.155     1.138
              1.122     1.104     1.077
PR    10      1.227     1.228     1.218     1.200     1.184     1.168     1.152
              1.133     1.114     1.085
PR    10      1.240     1.243     1.232     1.214     1.195     1.180     1.160
              1.143     1.123     1.094
SPED  12       0.40      0.50      0.60      0.70      0.75      0.80      0.85
               0.90      0.95      1.00      1.05      1.10
R      7        1.0       1.1       1.2       1.3       1.4       1.5       1.6
PR     7      1.024     1.020     1.014     1.009     1.006     1.004     1.002
R      8        1.0       1.1       1.2       1.3       1.4       1.5       1.6
                1.7
PR     8      1.037     1.035     1.029     1.023     1.020     1.016     1.014
              1.005
R      9        1.0       1.1       1.2       1.3       1.4       1.5       1.6
                1.7       1.8
PR     9      1.053     1.051     1.045     1.039     1.034     1.029     1.026
              1.016     1.005
R     10        1.0       1.1       1.2       1.3       1.4       1.5       1.6
                1.7       1.8       1.9
PR    10      1.069     1.067     1.061     1.054     1.048     1.042     1.037
              1.027     1.015     1.004
PR    10      1.078     1.075     1.069     1.062     1.055     1.049     1.043
              1.033     1.021     1.008
PR    10      1.088     1.084     1.076     1.069     1.063     1.055     1.049
              1.039     1.026     1.013
PR    10      1.099     1.093     1.085     1.078     1.070     1.062     1.055
              1.045     1.031     1.017
PR    10      1.109     1.101     1.093     1.086     1.077     1.068     1.061
              1.050     1.036     1.022
PR    10      1.121     1.110     1.102     1.094     1.085     1.075     1.067
              1.056     1.041     1.026
PR    10      1.132     1.118     1.109     1.102     1.092     1.082     1.073
              1.062     1.046     1.030
PR    10      1.144     1.126     1.117     1.110     1.099     1.088     1.078
              1.067     1.051     1.034
PR    10      1.157     1.134     1.124     1.116     1.105     1.094     1.082
              1.071     1.054     1.038
SPED  12       0.40      0.50      0.60      0.70      0.75      0.80      0.85
```

Listing of "*supersonic.maps*" (Continued)

```
                 0.90      0.95      1.00      1.05      1.10
R      10        1.0       1.1       1.2       1.3       1.4       1.5       1.6
                 1.7       1.8       1.9
PR     10        1.0036    1.0035    1.0030    1.0026    1.0021    1.0017    1.0013
                 1.0009    1.0005    1.0001
PR     10        1.0044    1.0042    1.0037    1.0033    1.0027    1.0022    1.0016
                 1.0011    1.0006    1.0001
PR     10        1.0050    1.0048    1.0044    1.0039    1.0031    1.0025    1.0020
                 1.0013    1.0007    1.0001
PR     10        1.0056    1.0053    1.0049    1.0043    1.0036    1.0028    1.0022
                 1.0015    1.0008    1.0001
PR     10        1.0058    1.0056    1.0052    1.0045    1.0038    1.0030    1.0023
                 1.0016    1.0008    1.0001
PR     10        1.0061    1.0058    1.0054    1.0047    1.0040    1.0031    1.0024
                 1.0016    1.0009    1.0001
PR     10        1.0064    1.0061    1.0057    1.0050    1.0042    1.0033    1.0025
                 1.0017    1.0009    1.0001
PR     10        1.0066    1.0063    1.0059    1.0052    1.0044    1.0034    1.0026
                 1.0018    1.0009    1.0001
PR     10        1.0070    1.0066    1.0062    1.0056    1.0047    1.0036    1.0028
                 1.0019    1.0010    1.0001
PR     10        1.0073    1.0069    1.0066    1.0058    1.0050    1.0038    1.0030
                 1.0020    1.0011    1.0001
PR     10        1.0075    1.0072    1.0068    1.0060    1.0052    1.0039    1.0031
                 1.0021    1.0011    1.0001
PR     10        1.0076    1.0072    1.0068    1.0061    1.0050    1.0039    1.0031
                 1.0021    1.0011    1.0001
EOT
 3801        HPT FLOW WITH VARIABLE AREA                                        0
AREA   3         0.50      1.00      1.50
SPED   3       4523.0    5654.0    6685.0
PR    14         1.000     1.300     1.500     1.600     1.800     2.000     2.200
                 2.500     2.800     3.100     3.300     3.500     3.600     5.000
FLOW 14          0.000     7.650     8.550     8.887     9.313     9.575     9.730
                 9.875     9.950     9.990    10.005    10.020    10.020    10.020
FLOW 14          0.000     7.887     8.550     8.787     9.112     9.350     9.520
                 9.680     9.770     9.820     9.835     9.850     9.850     9.850
FLOW 14          0.000     8.112     8.563     8.750     9.020     9.225     9.375
                 9.525     9.595     9.640     9.655     9.670     9.670     9.670
SPED   3       4523.0    5654.0    6685.0
PR    14         1.000     1.300     1.500     1.600     1.800     2.000     2.200
                 2.500     2.800     3.100     3.300     3.500     3.600     5.000
FLOW 14          0.000    15.300    17.100    17.775    18.625    19.150    19.460
                19.750    19.900    19.980    20.010    20.040    20.040    20.041
FLOW 14          0.000    15.775    17.100    17.575    18.225    18.700    19.040
                19.360    19.540    19.640    19.670    19.700    19.700    19.701
FLOW 14          0.000    16.225    17.125    17.500    18.040    18.450    18.750
                19.050    19.190    19.280    19.310    19.340    19.340    19.341
SPED   3       4523.0    5654.0    6685.0
PR    14         1.000     1.300     1.500     1.600     1.800     2.000     2.200
                 2.500     2.800     3.100     3.300     3.500     3.600     5.000
FLOW 14          0.000    22.950    25.650    26.662    27.938    28.725    29.190
                29.625    29.850    29.970    30.015    30.060    30.060    30.061
FLOW 14          0.000    23.662    25.650    26.362    27.337    28.050    28.560
                29.040    29.310    29.460    29.505    29.550    29.550    29.551
FLOW 14          0.000    24.337    25.688    26.250    27.060    27.675    28.125
                28.575    28.785    28.920    28.965    29.010    29.010    29.011
EOT
 3802        HPT EFF WITH VARIABLE AREA                                         0
AREA   3         0.50      1.00      1.50
SPED   4       4000.0    5000.0    5680.0    8000.0
PR    14         1.000     1.250     1.750     2.000     2.150     2.380     2.500
```

```
               2.750     3.250     3.500     4.000     4.500     4.750     5.000
EFF   14      0.7533    0.7577    0.7661    0.7702    0.7723    0.7753    0.7771
              0.7805    0.7861    0.7884    0.7907    0.7911    0.7904    0.7893
EFF   14      0.7560    0.7645    0.7791    0.7852    0.7888    0.7925    0.7930
              0.7933    0.7937    0.7938    0.7922    0.7886    0.7860    0.7830
EFF   14      0.7560    0.7643    0.7783    0.7834    0.7861    0.7895    0.7913
              0.7940    0.7981    0.7993    0.8002    0.7989    0.7976    0.7956
EFF   14      0.7560    0.7640    0.7772    0.7819    0.7840    0.7853    0.7859
              0.7862    0.7855    0.7848    0.7834    0.7819    0.7810    0.7801
SPED   4      4000.0    5000.0    5680.0    8000.0
PR    14       1.000     1.250     1.750     2.000     2.150     2.380     2.500
               2.750     3.250     3.500     4.000     4.500     4.750     5.000
EFF   14      0.8370    0.8419    0.8512    0.8557    0.8581    0.8615    0.8635
              0.8672    0.8734    0.8760    0.8786    0.8790    0.8782    0.8770
EFF   14      0.8400    0.8495    0.8657    0.8725    0.8765    0.8806    0.8811
              0.8815    0.8819    0.8820    0.8802    0.8762    0.8733    0.8700
EFF   14      0.8400    0.8492    0.8648    0.8705    0.8735    0.8772    0.8792
              0.8822    0.8867    0.8881    0.8891    0.8877    0.8862    0.8840
EFF   14      0.8400    0.8489    0.8636    0.8687    0.8711    0.8726    0.8732
              0.8736    0.8727    0.8720    0.8705    0.8688    0.8678    0.8668
SPED   4      4000.0    5000.0    5680.0    8000.0
PR    14       1.000     1.250     1.750     2.000     2.150     2.380     2.500
               2.750     3.250     3.500     4.000     4.500     4.750     5.000
EFF   14      0.7533    0.7577    0.7661    0.7702    0.7723    0.7753    0.7771
              0.7805    0.7861    0.7884    0.7907    0.7911    0.7904    0.7893
EFF   14      0.7560    0.7645    0.7791    0.7852    0.7888    0.7925    0.7930
              0.7933    0.7937    0.7938    0.7922    0.7886    0.7860    0.7830
EFF   14      0.7560    0.7643    0.7783    0.7834    0.7861    0.7895    0.7913
              0.7940    0.7981    0.7993    0.8002    0.7989    0.7976    0.7956
EFF   14      0.7560    0.7640    0.7772    0.7819    0.7840    0.7853    0.7859
              0.7862    0.7855    0.7848    0.7834    0.7819    0.7810    0.7801
EOT
 3803       LPT FLOW WITH VARIABLE AREA                                        0
AREA  3         0.50      1.00      1.50
SPED  3       4309.0    5244.0    6134.0
PR    14       1.000     1.020     1.100     1.150     1.200     1.300     1.350
               1.400     1.600     1.700     1.900     2.200     2.400     2.660
FLOW 14        0.000     9.250    17.100    19.550    21.200    24.000    25.250
              26.300    29.500    30.500    31.500    32.050    32.200    32.200
FLOW 14        0.000     7.750    15.600    18.400    20.300    23.250    24.350
              25.500    28.550    29.700    30.800    31.550    31.800    31.875
FLOW 14        0.000     7.750    15.100    17.300    19.125    22.100    23.300
              24.400    27.625    28.750    30.250    31.050    31.300    31.450
SPED  3       4309.0    5244.0    6134.0
PR    14       1.000     1.020     1.100     1.150     1.200     1.300     1.350
               1.400     1.600     1.700     1.900     2.200     2.400     2.660
FLOW 14        0.000    18.500    34.200    39.100    42.400    48.000    50.500
              52.600    59.000    61.000    63.000    64.100    64.400    64.400
FLOW 14        0.000    15.500    31.200    36.800    40.600    46.500    48.700
              51.000    57.100    59.400    61.600    63.100    63.600    63.750
FLOW 14        0.000    15.500    30.200    34.600    38.250    44.200    46.600
              48.800    55.250    57.500    60.500    62.100    62.600    62.900
SPED  3       4309.0    5244.0    6134.0
PR    14       1.000     1.020     1.100     1.150     1.200     1.300     1.350
               1.400     1.600     1.700     1.900     2.200     2.400     2.660
FLOW 14        0.000    27.750    51.300    58.650    63.600    72.000    75.750
              78.900    88.500    91.500    94.500    96.150    96.600    96.600
FLOW 14        0.000    23.250    46.800    55.200    60.900    69.750    73.050
              76.500    85.650    89.100    92.400    94.650    95.400    95.625
FLOW 14        0.000    23.250    45.300    51.900    57.375    66.300    69.900

              73.200    82.875    86.250    90.750    93.150    93.900    94.350
```

Listing of "*supersonic.maps*" (Continued)

```
EOT
 3804       LPT EFF WITH VARIABLE AREA                                        0
AREA  3       0.50      1.00      1.50
SPED  5     3070.0    3980.0    4470.0    4980.0    5970.0
PR   14      1.000     1.200     1.360     1.400     1.450     1.660     1.740
             1.820     2.000     2.100     2.300     2.500     2.600     2.660
EFF  14     0.7983    0.8132    0.8221    0.8231    0.8233    0.8156    0.8107
            0.8059    0.7956    0.7893    0.7830    0.7776    0.7767    0.7758
EFF  14     0.7998    0.8071    0.8127    0.8140    0.8156    0.8210    0.8227
            0.8236    0.8236    0.8219    0.8183    0.8140    0.8119    0.8105
EFF  14     0.7929    0.8005    0.8064    0.8077    0.8095    0.8163    0.8185
            0.8204    0.8231    0.8239    0.8240    0.8225    0.8213    0.8206
EFF  14     0.7961    0.8014    0.8052    0.8064    0.8075    0.8121    0.8138
            0.8154    0.8185    0.8201    0.8225    0.8239    0.8240    0.8242
EFF  14     0.8147    0.8158    0.8164    0.8167    0.8167    0.8176    0.8178
            0.8181    0.8185    0.8190    0.8195    0.8199    0.8199    0.8200
SPED  5     3070.0    3980.0    4470.0    4980.0    5970.0
PR   14      1.000     1.200     1.360     1.400     1.450     1.660     1.740
             1.820     2.000     2.100     2.300     2.500     2.600     2.660
EFF  14     0.8870    0.9036    0.9135    0.9145    0.9148    0.9062    0.9007
            0.8955    0.8840    0.8770    0.8700    0.8640    0.8630    0.8620
EFF  14     0.8887    0.8967    0.9030    0.9044    0.9062    0.9122    0.9141
            0.9151    0.9151    0.9132    0.9092    0.9045    0.9021    0.9006
EFF  14     0.8810    0.8895    0.8960    0.8975    0.8995    0.9070    0.9095
            0.9116    0.9146    0.9155    0.9156    0.9139    0.9126    0.9117
EFF  14     0.8846    0.8905    0.8947    0.8960    0.8972    0.9023    0.9042
            0.9060    0.9095    0.9112    0.9139    0.9154    0.9156    0.9158
EFF  14     0.9052    0.9064    0.9071    0.9074    0.9075    0.9084    0.9087
            0.9090    0.9095    0.9100    0.9105    0.9110    0.9110    0.9111
SPED  5     3070.0    3980.0    4470.0    4980.0    5970.0
PR   14      1.000     1.200     1.360     1.400     1.450     1.660     1.740
             1.820     2.000     2.100     2.300     2.500     2.600     2.660
EFF  14     0.7983    0.8132    0.8221    0.8231    0.8233    0.8156    0.8107
            0.8059    0.7956    0.7893    0.7830    0.7776    0.7767    0.7758
EFF  14     0.7998    0.8071    0.8127    0.8140    0.8156    0.8210    0.8227
            0.8236    0.8236    0.8219    0.8183    0.8140    0.8119    0.8105
EFF  14     0.7929    0.8005    0.8064    0.8077    0.8095    0.8163    0.8185
            0.8204    0.8231    0.8239    0.8240    0.8225    0.8213    0.8206
EFF  14     0.7961    0.8014    0.8052    0.8064    0.8075    0.8121    0.8138
            0.8154    0.8185    0.8201    0.8225    0.8239    0.8240    0.8242
EFF  14     0.8147    0.8158    0.8164    0.8167    0.8167    0.8176    0.8178
            0.8181    0.8185    0.8190    0.8195    0.8199    0.8199    0.8200
EOT
 8500   INSTAL7 M=2.4 'TCB92' INLET:  PT2/PT0 VS. M0
   Z  1   1.0
   Y  1   1.0
  M0 14   0.0000    0.2000    0.4000    0.6500    0.8000    1.0500    1.2000
          1.4000    1.6000    1.6010    1.8000    2.0000    2.2000    2.4000
  PR 14   0.9400    0.9620    0.9700    0.9700    0.9700    0.9700    0.9550
          0.9330    0.8910    0.9318    0.9318    0.9318    0.9318    0.9318
EOT
 8501   INSTAL7 M=2.4 'TCB92' INLET:  WCORR VS. M0
   Z  1   1.0
   Y  1   1.0
  M0 15   0.0000    0.2000    0.4000    0.6500    0.8000    0.9500    1.0500
          1.2000    1.4000    1.6000    1.6010    1.8000    2.0000    2.2000
          2.4000
FLOW 15   1.5000    1.5000    1.5000    1.5000    1.5100    1.5150    1.5250
          1.5130    1.4730    1.4090    1.4320    1.3520    1.2380    1.1200
          1.0000
EOT
```

A.5 Listing of *neutral.file*

All modules in the T/BEST executive system use the neutral file to exchange information. Once a module is executed, "*neutral.file*" is updated automatically reflecting the analysis just completed. The modules NNEPWATE, BLASIM, MTSB, and FLOPS communicate indirectly with "*neutral.file*" via their input generators and post-processors while the remaining T/BEST modules directly access and update the file. The format and content of the neutral file is discussed in Section 4.0 of this manual. Also, appendix C lists in details the neutral file parameters going to or coming from a module. The neutral file obtained by executing T/BEST for the supersonic engine example discussed in this appendix is listed here.

Listing of "*neutral.file*"

```
*** TBEST EXECUTIVE SYSTEM - NEUTRAL FILE UPDATE ***
----------------------------------------------------
ENGINE COMPONENT TYPE: FAN      NCC            2
NUMBER OF STAGES                NSTAGE         2
MINIMUM CRUISE SPEED            RPMCR       0.61060E+04
ROTOR SPEED                     RPM         0.61060E+04
MAXIMUM ROTOR SPEED             RPMAX       0.61060E+04
BLADE TAPER RATIO (HUB/TIP)     TR          0.18000E+01
UPSTREAM HUB RADIUS             RIUP1       0.12000E+02   (in.)
DOWNSTREAM HUB RADIUS           RIDW1       0.24000E+02   (in.)
UPSTREAM SHROUD RADIUS          ROUP1       0.31000E+02   (in.)
  STAGE NUMBER                  NS             1
   NUMBER OF BLADES             NB            33
   STAGE WEIGHT                 NSTW        0.53000E+03   (lbs)
   HUB RADIUS                   RHBA        0.11770E+02   (in.)
   TIP RADIUS                   RTBA        0.30970E+02   (in.)
   ASPECT RATIO                 AR          0.30000E+01
   MAXIMUM TEMPERATURE          TMAX        0.85400E+03   (R)
   BLADE ROOT ANGLE             THER        0.18435E+02   (deg.)
   STAGE LENGTH                 STL         0.13900E+02   (in.)
   BLADE BROACH ANGLE           BRANG       0.00000E+00   (deg.)
   BLADE STAGGER ANGLE          STAGG       0.35000E+02   (deg.)
   1ST STATION CHORD LENGTH     CHORD(1)    0.82286E+01   (in.)
   STAGE PRESSURE RATIO         PR          0.20900E+01
   STAGE PRESSURE               STAGEP      0.19720E+04   (lb/ft^2)
   STAGE TEMPERATURE            STAGET      0.51900E+03   (R)
   STAGE MASS FLOW RATE         STAGEF      0.69390E+03   (lb/sec)
   BLADE MATERIAL               MATSLC     TITANIUM
   AIRFOIL DEFINITION           AIRCODE    NACA 64-206 FAN
   FULL BLADE DEFINITION        ABLDEF
   BLADE UNTWIST                UTWIST     -0.40261E+01   (deg.)
   BLADE UNCAMBER               UCAMB      -0.76460E+00   (deg.)
   MAXIMUM TIP EXTENSION        TIPX        0.32700E-01   (in.)
   MAX. IN PLANE Y-DISPL.       TIPY        0.11305E+01   (in.)
   MAX. IN PLANE Z-DISPL.       TIPZ        0.31400E-01   (in.)
   FREQUENCY AT MIN. CRUISE     WMC1        0.15116E+03   (cps) MODE 1
   FREQUENCY AT ROTOR SPEED     w1          0.15117E+03   (cps) MODE 1
   FREQUENCY AT MAX. SPEED      WRL1        0.15116E+03   (cps) MODE 1
   MAXIMUM RESONANCE MARGIN     MAXMR11     0.48536E+00  EXCIT. ORDER 1
   MAXIMUM RESONANCE MARGIN     MAXMR12     0.25732E+00  EXCIT. ORDER 2
   MAXIMUM RESONANCE MARGIN     MAXMR13     0.50488E+00  EXCIT. ORDER 3
   MAXIMUM RESONANCE MARGIN     MAXMR14     0.62866E+00  EXCIT. ORDER 4
   MAXIMUM RESONANCE MARGIN     MAXMR15     0.70293E+00  EXCIT. ORDER 5
   FREQUENCY AT MIN. CRUISE     WMC2        0.32270E+03   (cps) MODE 2
   FREQUENCY AT ROTOR SPEED     w2          0.32270E+03   (cps) MODE 2
   FREQUENCY AT MAX. SPEED      WRL2        0.32270E+03   (cps) MODE 2
   MAXIMUM RESONANCE MARGIN     MAXMR21     0.21709E+01  EXCIT. ORDER 1
   MAXIMUM RESONANCE MARGIN     MAXMR22     0.58547E+00  EXCIT. ORDER 2
   MAXIMUM RESONANCE MARGIN     MAXMR23     0.56982E-01  EXCIT. ORDER 3
   MAXIMUM RESONANCE MARGIN     MAXMR24     0.20726E+00  EXCIT. ORDER 4
   MAXIMUM RESONANCE MARGIN     MAXMR25     0.36581E+00  EXCIT. ORDER 5
   FREQUENCY AT MIN. CRUISE     WMC3        0.37537E+03   (cps) MODE 3
   FREQUENCY AT ROTOR SPEED     w3          0.37538E+03   (cps) MODE 3
   FREQUENCY AT MAX. SPEED      WRL3        0.37537E+03   (cps) MODE 3
   MAXIMUM RESONANCE MARGIN     MAXMR31     0.26885E+01  EXCIT. ORDER 1
   MAXIMUM RESONANCE MARGIN     MAXMR32     0.84427E+00  EXCIT. ORDER 2
   MAXIMUM RESONANCE MARGIN     MAXMR33     0.22951E+00  EXCIT. ORDER 3
   MAXIMUM RESONANCE MARGIN     MAXMR34     0.77866E-01  EXCIT. ORDER 4
   MAXIMUM RESONANCE MARGIN     MAXMR35     0.26229E+00  EXCIT. ORDER 5
   FREQUENCY AT MIN. CRUISE     WMC4        0.70356E+03   (cps) MODE 4
   FREQUENCY AT ROTOR SPEED     w4          0.70357E+03   (cps) MODE 4
```


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FREQUENCY AT MAX. SPEED	WRL4	0.70356E+03	(cps) MODE 4
MAXIMUM RESONANCE MARGIN	MAXMR41	0.59135E+01	EXCIT. ORDER 1
MAXIMUM RESONANCE MARGIN	MAXMR42	0.24567E+01	EXCIT. ORDER 2
MAXIMUM RESONANCE MARGIN	MAXMR43	0.13045E+01	EXCIT. ORDER 3
MAXIMUM RESONANCE MARGIN	MAXMR44	0.72836E+00	EXCIT. ORDER 4
MAXIMUM RESONANCE MARGIN	MAXMR45	0.38269E+00	EXCIT. ORDER 5
FREQUENCY AT MIN. CRUISE	WMC5	0.71672E+03	(cps) MODE 5
FREQUENCY AT ROTOR SPEED	w5	0.71673E+03	(cps) MODE 5
FREQUENCY AT MAX. SPEED	WRL5	0.71672E+03	(cps) MODE 5
MAXIMUM RESONANCE MARGIN	MAXMR51	0.60428E+01	EXCIT. ORDER 1
MAXIMUM RESONANCE MARGIN	MAXMR52	0.25214E+01	EXCIT. ORDER 2
MAXIMUM RESONANCE MARGIN	MAXMR53	0.13476E+01	EXCIT. ORDER 3
MAXIMUM RESONANCE MARGIN	MAXMR54	0.76070E+00	EXCIT. ORDER 4
MAXIMUM RESONANCE MARGIN	MAXMR55	0.40856E+00	EXCIT. ORDER 5
MAX. MARGIN GOODMAN DIAG.	PMODE1	0.99400E+00	FINITE LIFE IF PMODE > 1.
MAX. MARGIN GOODMAN DIAG.	PMODE2	0.79330E+00	FINITE LIFE IF PMODE > 1.
MAX. MARGIN GOODMAN DIAG.	PMODE3	0.60240E+00	FINITE LIFE IF PMODE > 1.
MAX. MARGIN GOODMAN DIAG.	PMODE4	0.99400E+00	FINITE LIFE IF PMODE > 1.
MAX. MARGIN GOODMAN DIAG.	PMODE5	0.79330E+00	FINITE LIFE IF PMODE > 1.
ROOT STRESS	RSTRES	0.63131E+05	(psi)
MDE BLADE ROOT RESPONSE	FROOT	0.20026E+00	FAILURE IF FUNCTION > 1.
BLADE WEIGHT	WGHT	0.41727E+01	(lbs)
FOREIGN OBJECT VELOCITY	VELFOD	0.15000E+03	(knots)
FOREIGN OBJECT RADIUS	RADFOD	0.80000E+00	(in.)
IMPACT ANGLE	ANGFOD	0.22800E+02	(deg.)
STAGGER ANGLE AT IMPACT	STAFOD	0.33470E+02	(deg.)
FOREIGN OBJECT DENSITY	DENFOD	0.90000E-04	(lbm.sec^2/in^4)
IMPACT MAX. EDGE STRAIN	STRAIN	0.23642E+00	(%)
IMPACT ROOT DAMAGE	ROOTD	0.20000E-02	FAILURE IF FUNCTION > 1.
EFFICIENCY (KINETIC)	EFNCY	0.88460E+00	
PROFILE EFFICIENCY	EPROF	0.26100E-01	
ENDWALL EFFICIENCY	ENDWA	0.38000E-02	
SEC. LOSS EFFICIENCY	ESECL	0.30000E-03	
INCIDENCE EFFICIENCY	EINCD	0.79900E-01	
CLEARANCE EFFICIENCY	ECLEA	0.52000E-02	
WINDAGE EFFICIENCY	EWIND	0.00000E+00	
SUM ROTOR EFFICIENCY	ESUMR	0.11540E+00	
PROCESS	TYPROC	MAURER	
STOCK MATERIAL WEIGHT	SWGHT	0.00000E+00	(lbs)
MAURER WEIGHT FACTOR	MAURER	0.00000E+00	(lbs)
COST TO MANUFACTURE ONE	COST1	0.00000E+00	($)
DISK MATERIAL	DISMAT	TITANIUM	
DISK WEIGHT	DWGHT	0.00000E+00	(lbs)
PROCESS	TYPROC	MAURER	
STOCK MATERIAL WEIGHT	DSWGHT	0.00000E+00	(lbs)
MAURER WEIGHT FACTOR	MAURER	0.00000E+00	(lbs)
COST TO MANUFACTURE ONE	COST1	0.00000E+00	($)
TOTAL STAGE COST	COSTT	0.00000E+00	($)
STAGE NUMBER	NS	2	
NUMBER OF BLADES	NB	45	
STAGE WEIGHT	NSTW	0.46000E+03	(lbs)
HUB RADIUS	RHBA	0.21100E+02	(in.)
TIP RADIUS	RTBA	0.30190E+02	(in.)
ASPECT RATIO	AR	0.20000E+01	
MAXIMUM TEMPERATURE	TMAX	0.99400E+03	(R)
BLADE ROOT ANGLE	THER	0.18435E+02	(deg.)
STAGE LENGTH	STL	0.99000E+01	(in.)
BLADE BROACH ANGLE	BRANG	0.00000E+00	(deg.)
BLADE STAGGER ANGLE	STAGG	0.35000E+02	(deg.)
1ST STATION CHORD LENGTH	CHORD(1)	0.58436E+01	(in.)
STAGE PRESSURE RATIO	PR	0.18200E+01	
STAGE PRESSURE	STAGEP	0.41215E+04	(lb/ft^2)

Listing of "*neutral.file*" (Continued)

STAGE TEMPERATURE	STAGET	0.65600E+03	(R)
STAGE MASS FLOW RATE	STAGEF	0.69390E+03	(lb/sec)
BLADE MATERIAL	MATSLC	TITANIUM	
AIRFOIL DEFINITION	AIRCODE	NACA 64-206 FAN	
FULL BLADE DEFINITION	ABLDEF		
BLADE UNTWIST	UTWIST	-0.91650E+00	(deg.)
BLADE UNCAMBER	UCAMB	-0.28670E+00	(deg.)
MAXIMUM TIP EXTENSION	TIPX	0.81000E-02	(in.)
MAX. IN PLANE Y-DISPL.	TIPY	0.13320E+00	(in.)
MAX. IN PLANE Z-DISPL.	TIPZ	0.41000E-02	(in.)
FREQUENCY AT MIN. CRUISE	WMC1	0.27444E+03	(cps) MODE 1
FREQUENCY AT ROTOR SPEED	w1	0.27444E+03	(cps) MODE 1
FREQUENCY AT MAX. SPEED	WRL1	0.27444E+03	(cps) MODE 1
MAXIMUM RESONANCE MARGIN	MAXMR11	0.16967E+01	EXCIT. ORDER 1
MAXIMUM RESONANCE MARGIN	MAXMR12	0.34836E+00	EXCIT. ORDER 2
MAXIMUM RESONANCE MARGIN	MAXMR13	0.10109E+00	EXCIT. ORDER 3
MAXIMUM RESONANCE MARGIN	MAXMR14	0.32582E+00	EXCIT. ORDER 4
MAXIMUM RESONANCE MARGIN	MAXMR15	0.46066E+00	EXCIT. ORDER 5
FREQUENCY AT MIN. CRUISE	WMC2	0.65426E+03	(cps) MODE 2
FREQUENCY AT ROTOR SPEED	w2	0.65427E+03	(cps) MODE 2
FREQUENCY AT MAX. SPEED	WRL2	0.65426E+03	(cps) MODE 2
MAXIMUM RESONANCE MARGIN	MAXMR21	0.54290E+01	EXCIT. ORDER 1
MAXIMUM RESONANCE MARGIN	MAXMR22	0.22145E+01	EXCIT. ORDER 2
MAXIMUM RESONANCE MARGIN	MAXMR23	0.11430E+01	EXCIT. ORDER 3
MAXIMUM RESONANCE MARGIN	MAXMR24	0.60726E+00	EXCIT. ORDER 4
MAXIMUM RESONANCE MARGIN	MAXMR25	0.28581E+00	EXCIT. ORDER 5
FREQUENCY AT MIN. CRUISE	WMC3	0.80355E+03	(cps) MODE 3
FREQUENCY AT ROTOR SPEED	w3	0.80356E+03	(cps) MODE 3
FREQUENCY AT MAX. SPEED	WRL3	0.80355E+03	(cps) MODE 3
MAXIMUM RESONANCE MARGIN	MAXMR31	0.68960E+01	EXCIT. ORDER 1
MAXIMUM RESONANCE MARGIN	MAXMR32	0.29480E+01	EXCIT. ORDER 2
MAXIMUM RESONANCE MARGIN	MAXMR33	0.16320E+01	EXCIT. ORDER 3
MAXIMUM RESONANCE MARGIN	MAXMR34	0.97401E+00	EXCIT. ORDER 4
MAXIMUM RESONANCE MARGIN	MAXMR35	0.57921E+00	EXCIT. ORDER 5
FREQUENCY AT MIN. CRUISE	WMC4	0.14864E+04	(cps) MODE 4
FREQUENCY AT ROTOR SPEED	w4	0.14864E+04	(cps) MODE 4
FREQUENCY AT MAX. SPEED	WRL4	0.14864E+04	(cps) MODE 4
MAXIMUM RESONANCE MARGIN	MAXMR41	0.13606E+02	EXCIT. ORDER 1
MAXIMUM RESONANCE MARGIN	MAXMR42	0.63028E+01	EXCIT. ORDER 2
MAXIMUM RESONANCE MARGIN	MAXMR43	0.38685E+01	EXCIT. ORDER 3
MAXIMUM RESONANCE MARGIN	MAXMR44	0.26514E+01	EXCIT. ORDER 4
MAXIMUM RESONANCE MARGIN	MAXMR45	0.19211E+01	EXCIT. ORDER 5
FREQUENCY AT MIN. CRUISE	WMC5	0.17634E+04	(cps) MODE 5
FREQUENCY AT ROTOR SPEED	w5	0.17634E+04	(cps) MODE 5
FREQUENCY AT MAX. SPEED	WRL5	0.17634E+04	(cps) MODE 5
MAXIMUM RESONANCE MARGIN	MAXMR51	0.16328E+02	EXCIT. ORDER 1
MAXIMUM RESONANCE MARGIN	MAXMR52	0.76638E+01	EXCIT. ORDER 2
MAXIMUM RESONANCE MARGIN	MAXMR53	0.47759E+01	EXCIT. ORDER 3
MAXIMUM RESONANCE MARGIN	MAXMR54	0.33319E+01	EXCIT. ORDER 4
MAXIMUM RESONANCE MARGIN	MAXMR55	0.24655E+01	EXCIT. ORDER 5
MAX. MARGIN GOODMAN DIAG.	PMODE1	0.98710E+00	FINITE LIFE IF PMODE > 1.
MAX. MARGIN GOODMAN DIAG.	PMODE2	0.78750E+00	FINITE LIFE IF PMODE > 1.
MAX. MARGIN GOODMAN DIAG.	PMODE3	0.60260E+00	FINITE LIFE IF PMODE > 1.
MAX. MARGIN GOODMAN DIAG.	PMODE4	0.98710E+00	FINITE LIFE IF PMODE > 1.
MAX. MARGIN GOODMAN DIAG.	PMODE5	0.78750E+00	FINITE LIFE IF PMODE > 1.
ROOT STRESS	RSTRES	0.32966E+05	(psi)
MDE BLADE ROOT RESPONSE	FROOT	0.52601E-01	FAILURE IF FUNCTION > 1.
BLADE WEIGHT	WGHT	0.10012E+01	(lbs)
FOREIGN OBJECT VELOCITY	VELFOD	0.00000E+00	(knots)
FOREIGN OBJECT RADIUS	RADFOD	0.00000E+00	(in.)
IMPACT ANGLE	ANGFOD	0.00000E+00	(deg.)
STAGGER ANGLE AT IMPACT	STAFOD	0.00000E+00	(deg.)

Listing of "*neutral.file*" (Continued)

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     FOREIGN OBJECT DENSITY       DENFOD      0.00000E+00   (lbm.sec^2/in^4)
     IMPACT MAX. EDGE STRAIN      STRAIN      0.00000E+00   (%)
     IMPACT ROOT DAMAGE           ROOTD       0.00000E+00   FAILURE IF FUNCTION > 1.
     EFFICIENCY (KINETIC)         EFNCY       0.77940E+00
     PROFILE EFFICIENCY           EPROF       0.21100E-01
     ENDWALL EFFICIENCY           ENDWA       0.91000E-02
     SEC. LOSS EFFICIENCY         ESECL       0.10000E-03
     INCIDENCE EFFICIENCY         EINCD       0.18160E+00
     CLEARANCE EFFICIENCY         ECLEA       0.87000E-02
     WINDAGE EFFICIENCY           EWIND       0.00000E+00
     SUM ROTOR EFFICIENCY         ESUMR       0.22060E+00
     PROCESS                      TYPROC     MAURER
     STOCK MATERIAL WEIGHT        SWGHT       0.00000E+00   (lbs)
     MAURER WEIGHT FACTOR         MAURER      0.00000E+00   (lbs)
     COST TO MANUFACTURE ONE      COST1       0.00000E+00   ($)
     DISK MATERIAL                DISMAT     TITANIUM
     DISK WEIGHT                  DWGHT       0.00000E+00   (lbs)
     PROCESS                      TYPROC     MAURER
     STOCK MATERIAL WEIGHT        DSWGHT      0.00000E+00   (lbs)
     MAURER WEIGHT FACTOR         MAURER      0.00000E+00   (lbs)
     COST TO MANUFACTURE ONE      COST1       0.00000E+00   ($)
     TOTAL STAGE COST             COSTT       0.00000E+00   ($)
     TOTAL WEIGHT                 TWGHT       0.20121E+04   (lbs)
     TOTAL COST                   TCOST       0.00000E+00   ($)
ENGINE COMPONENT TYPE: HPC        NCC           5
NUMBER OF STAGES                  NSTAGE        5
MINIMUM CRUISE SPEED              RPMCR       0.67090E+04
ROTOR SPEED                       RPM         0.76480E+04
MAXIMUM ROTOR SPEED               RPMAX       0.85870E+04
BLADE TAPER RATIO (HUB/TIP)       TR          0.12000E+01
UPSTREAM HUB RADIUS               RIUP1       0.17000E+02   (in.)
DOWNSTREAM HUB RADIUS             RIDW1       0.20000E+02   (in.)
UPSTREAM SHROUD RADIUS            ROUP1       0.22000E+02   (in.)
  STAGE NUMBER                    NS            1
    NUMBER OF BLADES              NB           58
    STAGE WEIGHT                  NSTW        0.24600E+03   (lbs)
    HUB RADIUS                    RHBA        0.16660E+02   (in.)
    TIP RADIUS                    RTBA        0.21770E+02   (in.)
    ASPECT RATIO                  AR          0.20000E+01
    MAXIMUM TEMPERATURE           TMAX        0.11340E+04   (R)
    BLADE ROOT ANGLE              THER        0.85308E+01   (deg.)
    STAGE LENGTH                  STL         0.56000E+01   (in.)
    BLADE BROACH ANGLE            BRANG       0.00000E+00   (deg.)
    BLADE STAGGER ANGLE           STAGG       0.35000E+02   (deg.)
    1ST STATION CHORD LENGTH      CHORD(1)    0.27873E+01   (in.)
    STAGE PRESSURE RATIO          PR          0.15600E+01
    STAGE PRESSURE                STAGEP      0.74200E+04   (lb/ft^2)
    STAGE TEMPERATURE             STAGET      0.79300E+03   (R)
    STAGE MASS FLOW RATE          STAGEF      0.44750E+03   (lb/sec)
    BLADE MATERIAL                MATSLC     TITANIUM
    AIRFOIL DEFINITION            AIRCODE    NACA 64-206 FAN
    FULL BLADE DEFINITION         ABLDEF
    BLADE UNTWIST                 UTWIST     -0.86120E+00   (deg.)
    BLADE UNCAMBER                UCAMB      -0.26930E+00   (deg.)
    MAXIMUM TIP EXTENSION         TIPX        0.51000E-02   (in.)
    MAX. IN PLANE Y-DISPL.        TIPY        0.98000E-01   (in.)
    MAX. IN PLANE Z-DISPL.        TIPZ        0.31000E-02   (in.)
    FREQUENCY AT MIN. CRUISE      WMC1        0.32793E+03   (cps) MODE 1
    FREQUENCY AT ROTOR SPEED      w1          0.36324E+03   (cps) MODE 1
    FREQUENCY AT MAX. SPEED       WRL1        0.39941E+03   (cps) MODE 1
    MAXIMUM RESONANCE MARGIN      MAXMR11     0.17908E+01  EXCIT. ORDER 1
    MAXIMUM RESONANCE MARGIN      MAXMR12     0.39540E+00  EXCIT. ORDER 2
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Listing of "*neutral.file*" (Continued)

MAXIMUM RESONANCE MARGIN	MAXMR13	0.22409E-01	EXCIT. ORDER 3
MAXIMUM RESONANCE MARGIN	MAXMR14	0.26681E+00	EXCIT. ORDER 4
MAXIMUM RESONANCE MARGIN	MAXMR15	0.41345E+00	EXCIT. ORDER 5
FREQUENCY AT MIN. CRUISE	WMC2	0.76049E+03	(cps) MODE 2
FREQUENCY AT ROTOR SPEED	w2	0.77725E+03	(cps) MODE 2
FREQUENCY AT MAX. SPEED	WRL2	0.79577E+03	(cps) MODE 2
MAXIMUM RESONANCE MARGIN	MAXMR21	0.45603E+01	EXCIT. ORDER 1
MAXIMUM RESONANCE MARGIN	MAXMR22	0.17801E+01	EXCIT. ORDER 2
MAXIMUM RESONANCE MARGIN	MAXMR23	0.85343E+00	EXCIT. ORDER 3
MAXIMUM RESONANCE MARGIN	MAXMR24	0.39007E+00	EXCIT. ORDER 4
MAXIMUM RESONANCE MARGIN	MAXMR25	0.11206E+00	EXCIT. ORDER 5
FREQUENCY AT MIN. CRUISE	WMC3	0.11163E+04	(cps) MODE 3
FREQUENCY AT ROTOR SPEED	w3.	0.11678E+04	(cps) MODE 3
FREQUENCY AT MAX. SPEED	WRL3	0.12235E+04	(cps) MODE 3
MAXIMUM RESONANCE MARGIN	MAXMR31	0.75487E+01	EXCIT. ORDER 1
MAXIMUM RESONANCE MARGIN	MAXMR32	0.32744E+01	EXCIT. ORDER 2
MAXIMUM RESONANCE MARGIN	MAXMR33	0.18496E+01	EXCIT. ORDER 3
MAXIMUM RESONANCE MARGIN	MAXMR34	0.11372E+01	EXCIT. ORDER 4
MAXIMUM RESONANCE MARGIN	MAXMR35	0.70975E+00	EXCIT. ORDER 5
FREQUENCY AT MIN. CRUISE	WMC4	0.20910E+04	(cps) MODE 4
FREQUENCY AT ROTOR SPEED	w4	0.21193E+04	(cps) MODE 4
FREQUENCY AT MAX. SPEED	WRL4	0.21509E+04	(cps) MODE 4
MAXIMUM RESONANCE MARGIN	MAXMR41	0.14029E+02	EXCIT. ORDER 1
MAXIMUM RESONANCE MARGIN	MAXMR42	0.65145E+01	EXCIT. ORDER 2
MAXIMUM RESONANCE MARGIN	MAXMR43	0.40097E+01	EXCIT. ORDER 3
MAXIMUM RESONANCE MARGIN	MAXMR44	0.27573E+01	EXCIT. ORDER 4
MAXIMUM RESONANCE MARGIN	MAXMR45	0.20058E+01	EXCIT. ORDER 5
FREQUENCY AT MIN. CRUISE	WMC5	0.26342E+04	(cps) MODE 5
FREQUENCY AT ROTOR SPEED	w5	0.26840E+04	(cps) MODE 5
FREQUENCY AT MAX. SPEED	WRL5	0.27392E+04	(cps) MODE 5
MAXIMUM RESONANCE MARGIN	MAXMR51	0.18139E+02	EXCIT. ORDER 1
MAXIMUM RESONANCE MARGIN	MAXMR52	0.85697E+01	EXCIT. ORDER 2
MAXIMUM RESONANCE MARGIN	MAXMR53	0.53798E+01	EXCIT. ORDER 3
MAXIMUM RESONANCE MARGIN	MAXMR54	0.37848E+01	EXCIT. ORDER 4
MAXIMUM RESONANCE MARGIN	MAXMR55	0.28279E+01	EXCIT. ORDER 5
MAX. MARGIN GOODMAN DIAG.	PMODE1	0.99880E+00	FINITE LIFE IF PMODE > 1.
MAX. MARGIN GOODMAN DIAG.	PMODE2	0.79720E+00	FINITE LIFE IF PMODE > 1.
MAX. MARGIN GOODMAN DIAG.	PMODE3	0.60240E+00	FINITE LIFE IF PMODE > 1.
MAX. MARGIN GOODMAN DIAG.	PMODE4	0.99880E+00	FINITE LIFE IF PMODE > 1.
MAX. MARGIN GOODMAN DIAG.	PMODE5	0.79720E+00	FINITE LIFE IF PMODE > 1.
ROOT STRESS	RSTRES	0.33815E+05	(psi)
MDE BLADE ROOT RESPONSE	FROOT	0.51562E-01	FAILURE IF FUNCTION > 1.
BLADE WEIGHT	WGHT	0.22260E+00	(lbs)
FOREIGN OBJECT VELOCITY	VELFOD	0.00000E+00	(knots)
FOREIGN OBJECT RADIUS	RADFOD	0.00000E+00	(in.)
IMPACT ANGLE	ANGFOD	0.00000E+00	(deg.)
STAGGER ANGLE AT IMPACT	STAFOD	0.00000E+00	(deg.)
FOREIGN OBJECT DENSITY	DENFOD	0.00000E+00	(lbm.sec^2/in^4)
IMPACT MAX. EDGE STRAIN	STRAIN	0.00000E+00	(%)
IMPACT ROOT DAMAGE	ROOTD	0.00000E+00	FAILURE IF FUNCTION > 1.
EFFICIENCY (KINETIC)	EFNCY	0.89410E+00	
PROFILE EFFICIENCY	EPROF	0.12700E-01	
ENDWALL EFFICIENCY	ENDWA	0.49000E-02	
SEC. LOSS EFFICIENCY	ESECL	0.11000E-02	
INCIDENCE EFFICIENCY	EINCD	0.67800E-01	
CLEARANCE EFFICIENCY	ECLEA	0.19300E-01	
WINDAGE EFFICIENCY	EWIND	0.00000E+00	
SUM ROTOR EFFICIENCY	ESUMR	0.10590E+00	
PROCESS	TYPROC	MAURER	
STOCK MATERIAL WEIGHT	SWGHT	0.00000E+00	(lbs)
MAURER WEIGHT FACTOR	MAURER	0.00000E+00	(lbs)
COST TO MANUFACTURE ONE	COST1	0.00000E+00	($)

Listing of "*neutral.file*" (Continued)

DISK MATERIAL	DISMAT	TITANIUM	
DISK WEIGHT	DWGHT	0.00000E+00	(lbs)
PROCESS	TYPROC	MAURER	
STOCK MATERIAL WEIGHT	DSWGHT	0.00000E+00	(lbs)
MAURER WEIGHT FACTOR	MAURER	0.00000E+00	(lbs)
COST TO MANUFACTURE ONE	COST1	0.00000E+00	($)
TOTAL STAGE COST	COSTT	0.00000E+00	($)
STAGE NUMBER	NS	2	
NUMBER OF BLADES	NB	78	
STAGE WEIGHT	NSTW	0.18500E+03	(lbs)
HUB RADIUS	RHBA	0.18230E+02	(in.)
TIP RADIUS	RTBA	0.21770E+02	(in.)
ASPECT RATIO	AR	0.18500E+01	
MAXIMUM TEMPERATURE	TMAX	0.12550E+04	(R)
BLADE ROOT ANGLE	THER	0.85308E+01	(deg.)
STAGE LENGTH	STL	0.41000E+01	(in.)
BLADE BROACH ANGLE	BRANG	0.00000E+00	(deg.)
BLADE STAGGER ANGLE	STAGG	0.35000E+02	(deg.)
1ST STATION CHORD LENGTH	CHORD(1)	0.20875E+01	(in.)
STAGE PRESSURE RATIO	PR	0.14800E+01	
STAGE PRESSURE	STAGEP	0.11575E+05	(lb/ft^2)
STAGE TEMPERATURE	STAGET	0.90800E+03	(R)
STAGE MASS FLOW RATE	STAGEF	0.44750E+03	(lb/sec)
BLADE MATERIAL	MATSLC	TITANIUM	
AIRFOIL DEFINITION	AIRCODE	NACA 64-206 FAN	
FULL BLADE DEFINITION	ABLDEF		
BLADE UNTWIST	UTWIST	-0.44670E+00	(deg.)
BLADE UNCAMBER	UCAMB	-0.15680E+00	(deg.)
MAXIMUM TIP EXTENSION	TIPX	0.25000E-02	(in.)
MAX. IN PLANE Y-DISPL.	TIPY	0.43600E-01	(in.)
MAX. IN PLANE Z-DISPL.	TIPZ	0.14000E-02	(in.)
FREQUENCY AT MIN. CRUISE	WMC1	0.43538E+03	(cps) MODE 1
FREQUENCY AT ROTOR SPEED	w1	0.47523E+03	(cps) MODE 1
FREQUENCY AT MAX. SPEED	WRL1	0.51659E+03	(cps) MODE 1
MAXIMUM RESONANCE MARGIN	MAXMR11	0.26096E+01	EXCIT. ORDER 1
MAXIMUM RESONANCE MARGIN	MAXMR12	0.80478E+00	EXCIT. ORDER 2
MAXIMUM RESONANCE MARGIN	MAXMR13	0.20319E+00	EXCIT. ORDER 3
MAXIMUM RESONANCE MARGIN	MAXMR14	0.26583E-01	EXCIT. ORDER 4
MAXIMUM RESONANCE MARGIN	MAXMR15	0.22127E+00	EXCIT. ORDER 5
FREQUENCY AT MIN. CRUISE	WMC2	0.10851E+04	(cps) MODE 2
FREQUENCY AT ROTOR SPEED	w2	0.11021E+04	(cps) MODE 2
FREQUENCY AT MAX. SPEED	WRL2	0.11211E+04	(cps) MODE 2
MAXIMUM RESONANCE MARGIN	MAXMR21	0.68332E+01	EXCIT. ORDER 1
MAXIMUM RESONANCE MARGIN	MAXMR22	0.29166E+01	EXCIT. ORDER 2
MAXIMUM RESONANCE MARGIN	MAXMR23	0.16111E+01	EXCIT. ORDER 3
MAXIMUM RESONANCE MARGIN	MAXMR24	0.95829E+00	EXCIT. ORDER 4
MAXIMUM RESONANCE MARGIN	MAXMR25	0.56664E+00	EXCIT. ORDER 5
FREQUENCY AT MIN. CRUISE	WMC3	0.16240E+04	(cps) MODE 3
FREQUENCY AT ROTOR SPEED	w3	0.16767E+04	(cps) MODE 3
FREQUENCY AT MAX. SPEED	WRL3	0.17343E+04	(cps) MODE 3
MAXIMUM RESONANCE MARGIN	MAXMR31	0.11118E+02	EXCIT. ORDER 1
MAXIMUM RESONANCE MARGIN	MAXMR32	0.50591E+01	EXCIT. ORDER 2
MAXIMUM RESONANCE MARGIN	MAXMR33	0.30394E+01	EXCIT. ORDER 3
MAXIMUM RESONANCE MARGIN	MAXMR34	0.20296E+01	EXCIT. ORDER 4
MAXIMUM RESONANCE MARGIN	MAXMR35	0.14236E+01	EXCIT. ORDER 5
FREQUENCY AT MIN. CRUISE	WMC4	0.29903E+04	(cps) MODE 4
FREQUENCY AT ROTOR SPEED	w4	0.30193E+04	(cps) MODE 4
FREQUENCY AT MAX. SPEED	WRL4	0.30518E+04	(cps) MODE 4
MAXIMUM RESONANCE MARGIN	MAXMR41	0.20324E+02	EXCIT. ORDER 1
MAXIMUM RESONANCE MARGIN	MAXMR42	0.96621E+01	EXCIT. ORDER 2
MAXIMUM RESONANCE MARGIN	MAXMR43	0.61081E+01	EXCIT. ORDER 3
MAXIMUM RESONANCE MARGIN	MAXMR44	0.43310E+01	EXCIT. ORDER 4

Listing of "*neutral.file*" (Continued)

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 MAXIMUM RESONANCE MARGIN     MAXMR45     0.32648E+01    EXCIT. ORDER 5
 FREQUENCY AT MIN. CRUISE     WMC5        0.39091E+04    (cps) MODE 5
 FREQUENCY AT ROTOR SPEED     W5          0.39543E+04    (cps) MODE 5
 FREQUENCY AT MAX. SPEED      WRL5        0.40049E+04    (cps) MODE 5
 MAXIMUM RESONANCE MARGIN     MAXMR51     0.26983E+02    EXCIT. ORDER 1
 MAXIMUM RESONANCE MARGIN     MAXMR52     0.12992E+02    EXCIT. ORDER 2
 MAXIMUM RESONANCE MARGIN     MAXMR53     0.83278E+01    EXCIT. ORDER 3
 MAXIMUM RESONANCE MARGIN     MAXMR54     0.59959E+01    EXCIT. ORDER 4
 MAXIMUM RESONANCE MARGIN     MAXMR55     0.45967E+01    EXCIT. ORDER 5
 MAX. MARGIN GOODMAN DIAG.    PMODE1      0.99870E+00    FINITE LIFE IF PMODE > 1.
 MAX. MARGIN GOODMAN DIAG.    PMODE2      0.79680E+00    FINITE LIFE IF PMODE > 1.
 MAX. MARGIN GOODMAN DIAG.    PMODE3      0.60280E+00    FINITE LIFE IF PMODE > 1.
 MAX. MARGIN GOODMAN DIAG.    PMODE4      0.99870E+00    FINITE LIFE IF PMODE > 1.
 MAX. MARGIN GOODMAN DIAG.    PMODE5      0.79680E+00    FINITE LIFE IF PMODE > 1.
 ROOT STRESS                  RSTRES      0.23957E+05    (psi)
 MDE BLADE ROOT RESPONSE      FROOT       0.25518E-01    FAILURE IF FUNCTION > 1.
 BLADE WEIGHT                 WGHT        0.86540E-01    (lbs)
 FOREIGN OBJECT VELOCITY      VELFOD      0.00000E+00    (knots)
 FOREIGN OBJECT RADIUS        RADFOD      0.00000E+00    (in.)
 IMPACT ANGLE                 ANGFOD      0.00000E+00    (deg.)
 STAGGER ANGLE AT IMPACT      STAFOD      0.00000E+00    (deg.)
 FOREIGN OBJECT DENSITY       DENFOD      0.00000E+00    (lbm.sec^2/in^4)
 IMPACT MAX. EDGE STRAIN      STRAIN      0.00000E+00    (%)
 IMPACT ROOT DAMAGE           ROOTD       0.00000E+00    FAILURE IF FUNCTION > 1.
 EFFICIENCY (KINETIC)         EFNCY       0.85900E+00
 PROFILE EFFICIENCY           EPROF       0.17800E-01
 ENDWALL EFFICIENCY           ENDWA       0.80000E-02
 SEC. LOSS EFFICIENCY         ESECL       0.13000E-02
 INCIDENCE EFFICIENCY         EINCD       0.87200E-01
 CLEARANCE EFFICIENCY         ECLEA       0.26700E-01
 WINDAGE EFFICIENCY           EWIND       0.00000E+00
 SUM ROTOR EFFICIENCY         ESUMR       0.14100E+00
 PROCESS                      TYPROC     MAURER
 STOCK MATERIAL WEIGHT        SWGHT       0.00000E+00    (lbs)
 MAURER WEIGHT FACTOR         MAURER      0.00000E+00    (lbs)
 COST TO MANUFACTURE ONE      COST1       0.00000E+00    ($)
 DISK MATERIAL                DISMAT     TITANIUM
 DISK WEIGHT                  DWGHT       0.00000E+00    (lbs)
 PROCESS                      TYPROC     MAURER
 STOCK MATERIAL WEIGHT        DSWGHT      0.00000E+00    (lbs)
 MAURER WEIGHT FACTOR         MAURER      0.00000E+00    (lbs)
 COST TO MANUFACTURE ONE      COST1       0.00000E+00    ($)
 TOTAL STAGE COST             COSTT       0.00000E+00    ($)
STAGE NUMBER                  NS            3
 NUMBER OF BLADES             NB           97
 STAGE WEIGHT                 NSTW        0.14900E+03    (lbs)
 HUB RADIUS                   RHBA        0.19160E+02    (in.)
 TIP RADIUS                   RTBA        0.21770E+02    (in.)
 ASPECT RATIO                 AR          0.17000E+01
 MAXIMUM TEMPERATURE          TMAX        0.13760E+04    (R)
 BLADE ROOT ANGLE             THER        0.85308E+01    (deg.)
 STAGE LENGTH                 STL         0.33000E+01    (in.)
 BLADE BROACH ANGLE           BRANG       0.00000E+00    (deg.)
 BLADE STAGGER ANGLE          STAGG       0.35000E+02    (deg.)
 1ST STATION CHORD LENGTH     CHORD(1)    0.16749E+01    (in.)
 STAGE PRESSURE RATIO         PR          0.14200E+01
 STAGE PRESSURE               STAGEP      0.17131E+05    (lb/ft^2)
 STAGE TEMPERATURE            STAGET      0.10210E+04    (R)
 STAGE MASS FLOW RATE         STAGEF      0.44750E+03    (lb/sec)
 BLADE MATERIAL               MATSLC     TITANIUM
 AIRFOIL DEFINITION           AIRCODE    NACA 64-206 FAN
 FULL BLADE DEFINITION        ABLDEF
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Listing of "*neutral.file*" (Continued)

BLADE UNTWIST	UTWIST	-0.25840E+00	(deg.)
BLADE UNCAMBER	UCAMB	-0.10080E+00	(deg.)
MAXIMUM TIP EXTENSION	TIPX	0.14000E-02	(in.)
MAX. IN PLANE Y-DISPL.	TIPY	0.21800E-01	(in.)
MAX. IN PLANE Z-DISPL.	TIPZ	0.80000E-03	(in.)
FREQUENCY AT MIN. CRUISE	WMC1	0.56628E+03	(cps) MODE 1
FREQUENCY AT ROTOR SPEED	w1	0.60892E+03	(cps) MODE 1
FREQUENCY AT MAX. SPEED	WRL1	0.65378E+03	(cps) MODE 1
MAXIMUM RESONANCE MARGIN	MAXMR11	0.35681E+01	EXCIT. ORDER 1
MAXIMUM RESONANCE MARGIN	MAXMR12	0.12841E+01	EXCIT. ORDER 2
MAXIMUM RESONANCE MARGIN	MAXMR13	0.52271E+00	EXCIT. ORDER 3
MAXIMUM RESONANCE MARGIN	MAXMR14	0.14203E+00	EXCIT. ORDER 4
MAXIMUM RESONANCE MARGIN	MAXMR15	-0.12870E-01	EXCIT. ORDER 5
FREQUENCY AT MIN. CRUISE	WMC2	0.14684E+04	(cps) MODE 2
FREQUENCY AT ROTOR SPEED	w2	0.14854E+04	(cps) MODE 2
FREQUENCY AT MAX. SPEED	WRL2	0.15045E+04	(cps) MODE 2
MAXIMUM RESONANCE MARGIN	MAXMR21	0.95124E+01	EXCIT. ORDER 1
MAXIMUM RESONANCE MARGIN	MAXMR22	0.42562E+01	EXCIT. ORDER 2
MAXIMUM RESONANCE MARGIN	MAXMR23	0.25041E+01	EXCIT. ORDER 3
MAXIMUM RESONANCE MARGIN	MAXMR24	0.16281E+01	EXCIT. ORDER 4
MAXIMUM RESONANCE MARGIN	MAXMR25	0.11025E+01	EXCIT. ORDER 5
FREQUENCY AT MIN. CRUISE	WMC3	0.22864E+04	(cps) MODE 3
FREQUENCY AT ROTOR SPEED	w3	0.23378E+04	(cps) MODE 3
FREQUENCY AT MAX. SPEED	WRL3	0.23946E+04	(cps) MODE 3
MAXIMUM RESONANCE MARGIN	MAXMR31	0.15732E+02	EXCIT. ORDER 1
MAXIMUM RESONANCE MARGIN	MAXMR32	0.73660E+01	EXCIT. ORDER 2
MAXIMUM RESONANCE MARGIN	MAXMR33	0.45773E+01	EXCIT. ORDER 3
MAXIMUM RESONANCE MARGIN	MAXMR34	0.31830E+01	EXCIT. ORDER 4
MAXIMUM RESONANCE MARGIN	MAXMR35	0.23464E+01	EXCIT. ORDER 5
FREQUENCY AT MIN. CRUISE	WMC4	0.40395E+04	(cps) MODE 4
FREQUENCY AT ROTOR SPEED	w4	0.40685E+04	(cps) MODE 4
FREQUENCY AT MAX. SPEED	WRL4	0.41010E+04	(cps) MODE 4
MAXIMUM RESONANCE MARGIN	MAXMR41	0.27655E+02	EXCIT. ORDER 1
MAXIMUM RESONANCE MARGIN	MAXMR42	0.13327E+02	EXCIT. ORDER 2
MAXIMUM RESONANCE MARGIN	MAXMR43	0.85516E+01	EXCIT. ORDER 3
MAXIMUM RESONANCE MARGIN	MAXMR44	0.61637E+01	EXCIT. ORDER 4
MAXIMUM RESONANCE MARGIN	MAXMR45	0.47309E+01	EXCIT. ORDER 5
FREQUENCY AT MIN. CRUISE	WMC5	0.53260E+04	(cps) MODE 5
FREQUENCY AT ROTOR SPEED	w5	0.53470E+04	(cps) MODE 5
FREQUENCY AT MAX. SPEED	WRL5	0.53706E+04	(cps) MODE 5
MAXIMUM RESONANCE MARGIN	MAXMR51	0.36526E+02	EXCIT. ORDER 1
MAXIMUM RESONANCE MARGIN	MAXMR52	0.17763E+02	EXCIT. ORDER 2
MAXIMUM RESONANCE MARGIN	MAXMR53	0.11509E+02	EXCIT. ORDER 3
MAXIMUM RESONANCE MARGIN	MAXMR54	0.83814E+01	EXCIT. ORDER 4
MAXIMUM RESONANCE MARGIN	MAXMR55	0.65051E+01	EXCIT. ORDER 5
MAX. MARGIN GOODMAN DIAG.	PMODE1	0.25698E+01	FINITE LIFE IF PMODE > 1.
MAX. MARGIN GOODMAN DIAG.	PMODE2	0.79660E+00	FINITE LIFE IF PMODE > 1.
MAX. MARGIN GOODMAN DIAG.	PMODE3	0.60250E+00	FINITE LIFE IF PMODE > 1.
MAX. MARGIN GOODMAN DIAG.	PMODE4	0.99810E+00	FINITE LIFE IF PMODE > 1.
MAX. MARGIN GOODMAN DIAG.	PMODE5	0.79660E+00	FINITE LIFE IF PMODE > 1.
ROOT STRESS	RSTRES	0.17837E+05	(psi)
MDE BLADE ROOT RESPONSE	FROOT	0.14044E-01	FAILURE IF FUNCTION > 1.
BLADE WEIGHT	WGHT	0.41080E-01	(lbs)
FOREIGN OBJECT VELOCITY	VELFOD	0.00000E+00	(knots)
FOREIGN OBJECT RADIUS	RADFOD	0.00000E+00	(in.)
IMPACT ANGLE	ANGFOD	0.00000E+00	(deg.)
STAGGER ANGLE AT IMPACT	STAFOD	0.00000E+00	(deg.)
FOREIGN OBJECT DENSITY	DENFOD	0.00000E+00	(lbm.sec^2/in^4)
IMPACT MAX. EDGE STRAIN	STRAIN	0.00000E+00	(%)
IMPACT ROOT DAMAGE	ROOTD	0.00000E+00	FAILURE IF FUNCTION > 1.
EFFICIENCY (KINETIC)	EFNCY	0.82880E+00	
PROFILE EFFICIENCY	EPROF	0.18200E-01	

Listing of "*neutral.file*" (Continued)

ENDWALL EFFICIENCY	ENDWA	0.81000E-02	
SEC. LOSS EFFICIENCY	ESECL	0.21000E-02	
INCIDENCE EFFICIENCY	EINCD	0.10830E+00	
CLEARANCE EFFICIENCY	ECLEA	0.34600E-01	
WINDAGE EFFICIENCY	EWIND	0.00000E+00	
SUM ROTOR EFFICIENCY	ESUMR	0.17120E+00	
PROCESS	TYPROC	MAURER	
STOCK MATERIAL WEIGHT	SWGHT	0.00000E+00	(lbs)
MAURER WEIGHT FACTOR	MAURER	0.00000E+00	(lbs)
COST TO MANUFACTURE ONE	COST1	0.00000E+00	($)
DISK MATERIAL	DISMAT	TITANIUM	
DISK WEIGHT	DWGHT	0.00000E+00	(lbs)
PROCESS	TYPROC	MAURER	
STOCK MATERIAL WEIGHT	DSWGHT	0.00000E+00	(lbs)
MAURER WEIGHT FACTOR	MAURER	0.00000E+00	(lbs)
COST TO MANUFACTURE ONE	COST1	0.00000E+00	($)
TOTAL STAGE COST	COSTT	0.00000E+00	($)
STAGE NUMBER	NS	4	
NUMBER OF BLADES	NB	115	
STAGE WEIGHT	NSTW	0.12700E+03	(lbs)
HUB RADIUS	RHBA	0.19740E+02	(in.)
TIP RADIUS	RTBA	0.21770E+02	(in.)
ASPECT RATIO	AR	0.15500E+01	
MAXIMUM TEMPERATURE	TMAX	0.14970E+04	(R)
BLADE ROOT ANGLE	THER	0.85308E+01	(deg.)
STAGE LENGTH	STL	0.28000E+01	(in.)
BLADE BROACH ANGLE	BRANG	0.00000E+00	(deg.)
BLADE STAGGER ANGLE	STAGG	0.35000E+02	(deg.)
1ST STATION CHORD LENGTH	CHORD(1)	0.14287E+01	(in.)
STAGE PRESSURE RATIO	PR	0.13700E+01	
STAGE PRESSURE	STAGEP	0.24326E+05	(lb/ft^2)
STAGE TEMPERATURE	STAGET	0.11330E+04	(R)
STAGE MASS FLOW RATE	STAGEF	0.44750E+03	(lb/sec)
BLADE MATERIAL	MATSLC	TITANIUM	
AIRFOIL DEFINITION	AIRCODE	NACA 64-206 FAN	
FULL BLADE DEFINITION	ABLDEF		
BLADE UNTWIST	UTWIST	-0.16580E+00	(deg.)
BLADE UNCAMBER	UCAMB	-0.77700E-01	(deg.)
MAXIMUM TIP EXTENSION	TIPX	0.80000E-03	(in.)
MAX. IN PLANE Y-DISPL.	TIPY	0.12300E-01	(in.)
MAX. IN PLANE Z-DISPL.	TIPZ	0.40000E-03	(in.)
FREQUENCY AT MIN. CRUISE	WMC1	0.72628E+03	(cps) MODE 1
FREQUENCY AT ROTOR SPEED	w1	0.76991E+03	(cps) MODE 1
FREQUENCY AT MAX. SPEED	WRL1	0.81642E+03	(cps) MODE 1
MAXIMUM RESONANCE MARGIN	MAXMR11	0.47046E+01	EXCIT. ORDER 1
MAXIMUM RESONANCE MARGIN	MAXMR12	0.18523E+01	EXCIT. ORDER 2
MAXIMUM RESONANCE MARGIN	MAXMR13	0.90153E+00	EXCIT. ORDER 3
MAXIMUM RESONANCE MARGIN	MAXMR14	0.42615E+00	EXCIT. ORDER 4
MAXIMUM RESONANCE MARGIN	MAXMR15	0.14092E+00	EXCIT. ORDER 5
FREQUENCY AT MIN. CRUISE	WMC2	0.18981E+04	(cps) MODE 2
FREQUENCY AT ROTOR SPEED	w2	0.19152E+04	(cps) MODE 2
FREQUENCY AT MAX. SPEED	WRL2	0.19343E+04	(cps) MODE 2
MAXIMUM RESONANCE MARGIN	MAXMR21	0.12515E+02	EXCIT. ORDER 1
MAXIMUM RESONANCE MARGIN	MAXMR22	0.57576E+01	EXCIT. ORDER 2
MAXIMUM RESONANCE MARGIN	MAXMR23	0.35051E+01	EXCIT. ORDER 3
MAXIMUM RESONANCE MARGIN	MAXMR24	0.23788E+01	EXCIT. ORDER 4
MAXIMUM RESONANCE MARGIN	MAXMR25	0.17031E+01	EXCIT. ORDER 5
FREQUENCY AT MIN. CRUISE	WMC3	0.31247E+04	(cps) MODE 3
FREQUENCY AT ROTOR SPEED	w3	0.31735E+04	(cps) MODE 3
FREQUENCY AT MAX. SPEED	WRL3	0.32277E+04	(cps) MODE 3
MAXIMUM RESONANCE MARGIN	MAXMR31	0.21553E+02	EXCIT. ORDER 1
MAXIMUM RESONANCE MARGIN	MAXMR32	0.10276E+02	EXCIT. ORDER 2

Listing of "*neutral.file*" (Continued)

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MAXIMUM RESONANCE MARGIN    MAXMR33   0.65175E+01   EXCIT. ORDER 3
MAXIMUM RESONANCE MARGIN    MAXMR34   0.46382E+01   EXCIT. ORDER 4
MAXIMUM RESONANCE MARGIN    MAXMR35   0.35105E+01   EXCIT. ORDER 5
FREQUENCY AT MIN. CRUISE    WMC4      0.52039E+04   (cps) MODE 4
FREQUENCY AT ROTOR SPEED    w4        0.52323E+04   (cps) MODE 4
FREQUENCY AT MAX. SPEED     WRL4      0.52643E+04   (cps) MODE 4
MAXIMUM RESONANCE MARGIN    MAXMR41   0.35783E+02   EXCIT. ORDER 1
MAXIMUM RESONANCE MARGIN    MAXMR42   0.17392E+02   EXCIT. ORDER 2
MAXIMUM RESONANCE MARGIN    MAXMR43   0.11261E+02   EXCIT. ORDER 3
MAXIMUM RESONANCE MARGIN    MAXMR44   0.81959E+01   EXCIT. ORDER 4
MAXIMUM RESONANCE MARGIN    MAXMR45   0.63567E+01   EXCIT. ORDER 5
FREQUENCY AT MIN. CRUISE    WMC5      0.64251E+04   (cps) MODE 5
FREQUENCY AT ROTOR SPEED    w5        0.64333E+04   (cps) MODE 5
FREQUENCY AT MAX. SPEED     WRL5      0.64427E+04   (cps) MODE 5
MAXIMUM RESONANCE MARGIN    MAXMR51   0.44017E+02   EXCIT. ORDER 1
MAXIMUM RESONANCE MARGIN    MAXMR52   0.21508E+02   EXCIT. ORDER 2
MAXIMUM RESONANCE MARGIN    MAXMR53   0.14006E+02   EXCIT. ORDER 3
MAXIMUM RESONANCE MARGIN    MAXMR54   0.10254E+02   EXCIT. ORDER 4
MAXIMUM RESONANCE MARGIN    MAXMR55   0.80034E+01   EXCIT. ORDER 5
MAX. MARGIN GOODMAN DIAG.   PMODE1    0.99790E+00   FINITE LIFE IF PMODE > 1.
MAX. MARGIN GOODMAN DIAG.   PMODE2    0.79660E+00   FINITE LIFE IF PMODE > 1.
MAX. MARGIN GOODMAN DIAG.   PMODE3    0.60230E+00   FINITE LIFE IF PMODE > 1.
MAX. MARGIN GOODMAN DIAG.   PMODE4    0.99790E+00   FINITE LIFE IF PMODE > 1.
MAX. MARGIN GOODMAN DIAG.   PMODE5    0.79660E+00   FINITE LIFE IF PMODE > 1.
ROOT STRESS                 RSTRES    0.14236E+05   (psi)
MDE BLADE ROOT RESPONSE     FROOT     0.89139E-02   FAILURE IF FUNCTION > 1.
BLADE WEIGHT                WGHT      0.23292E-01   (lbs)
FOREIGN OBJECT VELOCITY     VELFOD    0.00000E+00   (knots)
FOREIGN OBJECT RADIUS       RADFOD    0.00000E+00   (in.)
IMPACT ANGLE                ANGFOD    0.00000E+00   (deg.)
STAGGER ANGLE AT IMPACT     STAFOD    0.00000E+00   (deg.)
FOREIGN OBJECT DENSITY      DENFOD    0.00000E+00   (lbm.sec^2/in^4)
IMPACT MAX. EDGE STRAIN     STRAIN    0.00000E+00   (%)
IMPACT ROOT DAMAGE          ROOTD     0.00000E+00   FAILURE IF FUNCTION > 1.
EFFICIENCY (KINETIC)        EFNCY     0.79970E+00
PROFILE EFFICIENCY          EPROF     0.13500E-01
ENDWALL EFFICIENCY          ENDWA     0.86000E-02
SEC. LOSS EFFICIENCY        ESECL     0.27000E-02
INCIDENCE EFFICIENCY        EINCD     0.13310E+00
CLEARANCE EFFICIENCY        ECLEA     0.42400E-01
WINDAGE EFFICIENCY          EWIND     0.00000E+00
SUM ROTOR EFFICIENCY        ESUMR     0.20030E+00
PROCESS                     TYPROC   MAURER
STOCK MATERIAL WEIGHT       SWGHT     0.00000E+00   (lbs)
MAURER WEIGHT FACTOR        MAURER    0.00000E+00   (lbs)
COST TO MANUFACTURE ONE     COST1     0.00000E+00   ($)
DISK MATERIAL               DISMAT   TITANIUM
DISK WEIGHT                 DWGHT     0.00000E+00   (lbs)
PROCESS                     TYPROC   MAURER
STOCK MATERIAL WEIGHT       DSWGHT    0.00000E+00   (lbs)
MAURER WEIGHT FACTOR        MAURER    0.00000E+00   (lbs)
COST TO MANUFACTURE ONE     COST1     0.00000E+00   ($)
TOTAL STAGE COST            COSTT     0.00000E+00   ($)
STAGE NUMBER                NS          5
NUMBER OF BLADES            NB        128
STAGE WEIGHT                NSTW      0.11300E+03   (lbs)
HUB RADIUS                  RHBA      0.20140E+02   (in.)
TIP RADIUS                  RTBA      0.21770E+02   (in.)
ASPECT RATIO                AR        0.14000E+01
MAXIMUM TEMPERATURE         TMAX      0.16180E+04   (R)
BLADE ROOT ANGLE            THER      0.85308E+01   (deg.)
STAGE LENGTH                STL       0.25000E+01   (in.)
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Listing of "*neutral.file*" (Continued)

BLADE BROACH ANGLE	BRANG	0.00000E+00	(deg.)
BLADE STAGGER ANGLE	STAGG	0.35000E+02	(deg.)
1ST STATION CHORD LENGTH	CHORD(1)	0.12701E+01	(in.)
STAGE PRESSURE RATIO	PR	0.13400E+01	
STAGE PRESSURE	STAGEP	0.33327E+05	(lb/ft^2)
STAGE TEMPERATURE	STAGET	0.12440E+04	(R)
STAGE MASS FLOW RATE	STAGEF	0.44750E+03	(lb/sec)
BLADE MATERIAL	MATSLC	TITANIUM	
AIRFOIL DEFINITION	AIRCODE	NACA 64-206 FAN	
FULL BLADE DEFINITION	ABLDEF		
BLADE UNTWIST	UTWIST	-0.11050E+00	(deg.)
BLADE UNCAMBER	UCAMB	-0.63600E-01	(deg.)
MAXIMUM TIP EXTENSION	TIPX	0.50000E-03	(in.)
MAX. IN PLANE Y-DISPL.	TIPY	0.69000E-02	(in.)
MAX. IN PLANE Z-DISPL.	TIPZ	0.20000E-03	(in.)
FREQUENCY AT MIN. CRUISE	WMC1	0.92508E+03	(cps) MODE 1
FREQUENCY AT ROTOR SPEED	w1	0.96832E+03	(cps) MODE 1
FREQUENCY AT MAX. SPEED	WRL1	0.10150E+04	(cps) MODE 1
MAXIMUM RESONANCE MARGIN	MAXMR11	0.60919E+01	EXCIT. ORDER 1
MAXIMUM RESONANCE MARGIN	MAXMR12	0.25460E+01	EXCIT. ORDER 2
MAXIMUM RESONANCE MARGIN	MAXMR13	0.13640E+01	EXCIT. ORDER 3
MAXIMUM RESONANCE MARGIN	MAXMR14	0.77298E+00	EXCIT. ORDER 4
MAXIMUM RESONANCE MARGIN	MAXMR15	0.41838E+00	EXCIT. ORDER 5
FREQUENCY AT MIN. CRUISE	WMC2	0.23696E+04	(cps) MODE 2
FREQUENCY AT ROTOR SPEED	w2	0.23866E+04	(cps) MODE 2
FREQUENCY AT MAX. SPEED	WRL2	0.24056E+04	(cps) MODE 2
MAXIMUM RESONANCE MARGIN	MAXMR21	0.15809E+02	EXCIT. ORDER 1
MAXIMUM RESONANCE MARGIN	MAXMR22	0.74043E+01	EXCIT. ORDER 2
MAXIMUM RESONANCE MARGIN	MAXMR23	0.46028E+01	EXCIT. ORDER 3
MAXIMUM RESONANCE MARGIN	MAXMR24	0.32021E+01	EXCIT. ORDER 4
MAXIMUM RESONANCE MARGIN	MAXMR25	0.23617E+01	EXCIT. ORDER 5
FREQUENCY AT MIN. CRUISE	WMC3	0.41801E+04	(cps) MODE 3
FREQUENCY AT ROTOR SPEED	w3	0.42254E+04	(cps) MODE 3
FREQUENCY AT MAX. SPEED	WRL3	0.42761E+04	(cps) MODE 3
MAXIMUM RESONANCE MARGIN	MAXMR31	0.28878E+02	EXCIT. ORDER 1
MAXIMUM RESONANCE MARGIN	MAXMR32	0.13939E+02	EXCIT. ORDER 2
MAXIMUM RESONANCE MARGIN	MAXMR33	0.89594E+01	EXCIT. ORDER 3
MAXIMUM RESONANCE MARGIN	MAXMR34	0.64695E+01	EXCIT. ORDER 4
MAXIMUM RESONANCE MARGIN	MAXMR35	0.49756E+01	EXCIT. ORDER 5
FREQUENCY AT MIN. CRUISE	WMC4	0.64872E+04	(cps) MODE 4
FREQUENCY AT ROTOR SPEED	w4	0.65153E+04	(cps) MODE 4
FREQUENCY AT MAX. SPEED	WRL4	0.65468E+04	(cps) MODE 4
MAXIMUM RESONANCE MARGIN	MAXMR41	0.44745E+02	EXCIT. ORDER 1
MAXIMUM RESONANCE MARGIN	MAXMR42	0.21872E+02	EXCIT. ORDER 2
MAXIMUM RESONANCE MARGIN	MAXMR43	0.14248E+02	EXCIT. ORDER 3
MAXIMUM RESONANCE MARGIN	MAXMR44	0.10436E+02	EXCIT. ORDER 4
MAXIMUM RESONANCE MARGIN	MAXMR45	0.81490E+01	EXCIT. ORDER 5
FREQUENCY AT MIN. CRUISE	WMC5	0.73598E+04	(cps) MODE 5
FREQUENCY AT ROTOR SPEED	w5	0.73668E+04	(cps) MODE 5
FREQUENCY AT MAX. SPEED	WRL5	0.73746E+04	(cps) MODE 5
MAXIMUM RESONANCE MARGIN	MAXMR51	0.50529E+02	EXCIT. ORDER 1
MAXIMUM RESONANCE MARGIN	MAXMR52	0.24764E+02	EXCIT. ORDER 2
MAXIMUM RESONANCE MARGIN	MAXMR53	0.16176E+02	EXCIT. ORDER 3
MAXIMUM RESONANCE MARGIN	MAXMR54	0.11882E+02	EXCIT. ORDER 4
MAXIMUM RESONANCE MARGIN	MAXMR55	0.93057E+01	EXCIT. ORDER 5
MAX. MARGIN GOODMAN DIAG.	PMODE1	0.99700E+00	FINITE LIFE IF PMODE > 1.
MAX. MARGIN GOODMAN DIAG.	PMODE2	0.79520E+00	FINITE LIFE IF PMODE > 1.
MAX. MARGIN GOODMAN DIAG.	PMODE3	0.60310E+00	FINITE LIFE IF PMODE > 1.
MAX. MARGIN GOODMAN DIAG.	PMODE4	0.99700E+00	FINITE LIFE IF PMODE > 1.
MAX. MARGIN GOODMAN DIAG.	PMODE5	0.79520E+00	FINITE LIFE IF PMODE > 1.
ROOT STRESS	RSTRES	0.11282E+05	(psi)
MDE BLADE ROOT RESPONSE	FROOT	0.56146E-02	FAILURE IF FUNCTION > 1.

Listing of "*neutral.file*" (Continued)

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    BLADE WEIGHT               WGHT       0.14753E-01   (lbs)
    FOREIGN OBJECT VELOCITY    VELFOD     0.00000E+00   (knots)
    FOREIGN OBJECT RADIUS      RADFOD     0.00000E+00   (in.)
    IMPACT ANGLE               ANGFOD     0.00000E+00   (deg.)
    STAGGER ANGLE AT IMPACT    STAFOD     0.00000E+00   (deg.)
    FOREIGN OBJECT DENSITY     DENFOD     0.00000E+00   (lbm.sec^2/in^4)
    IMPACT MAX. EDGE STRAIN    STRAIN     0.00000E+00   (%)
    IMPACT ROOT DAMAGE         ROOTD      0.00000E+00   FAILURE IF FUNCTION > 1.
    EFFICIENCY (KINETIC)       EFNCY      0.76580E+00
    PROFILE EFFICIENCY         EPROF      0.14000E-01
    ENDWALL EFFICIENCY         ENDWA      0.99000E-02
    SEC. LOSS EFFICIENCY       ESECL      0.40000E-02
    INCIDENCE EFFICIENCY       EINCD      0.15620E+00
    CLEARANCE EFFICIENCY       ECLEA      0.50100E-01
    WINDAGE EFFICIENCY         EWIND      0.00000E+00
    SUM ROTOR EFFICIENCY       ESUMR      0.23420E+00
    PROCESS                    TYPROC   MAURER
    STOCK MATERIAL WEIGHT      SWGHT      0.00000E+00   (lbs)
    MAURER WEIGHT FACTOR       MAURER     0.00000E+00   (lbs)
    COST TO MANUFACTURE ONE    COST1      0.00000E+00   ($)
    DISK MATERIAL              DISMAT   TITANIUM
    DISK WEIGHT                DWGHT      0.00000E+00   (lbs)
    PROCESS                    TYPROC   MAURER
    STOCK MATERIAL WEIGHT      DSWGHT     0.00000E+00   (lbs)
    MAURER WEIGHT FACTOR       MAURER     0.00000E+00   (lbs)
    COST TO MANUFACTURE ONE    COST1      0.00000E+00   ($)
    TOTAL STAGE COST           COSTT      0.00000E+00   ($)
    TOTAL WEIGHT               TWGHT      0.12505E+04   (lbs)
    TOTAL COST                 TCOST      0.00000E+00   ($)
ENGINE COMPONENT TYPE: HPT     NCC            8
NUMBER OF STAGES               NSTAGE         1
MINIMUM CRUISE SPEED           RPMCR      0.67090E+04
ROTOR SPEED                    RPM        0.76480E+04
MAXIMUM ROTOR SPEED            RPMAX      0.85870E+04
BLADE TAPER RATIO (HUB/TIP)    TR         0.10000E+01
UPSTREAM HUB RADIUS            RIUP1      0.20000E+02   (in.)
DOWNSTREAM HUB RADIUS          RIDW1      0.20000E+02   (in.)
UPSTREAM SHROUD RADIUS         ROUP1      0.22000E+02   (in.)
  STAGE NUMBER                 NS             1
   NUMBER OF BLADES            NB           116
   STAGE WEIGHT                NSTW       0.57000E+03   (lbs)
   HUB RADIUS                  RHBA       0.19900E+02   (in.)
   TIP RADIUS                  RTBA       0.22440E+02   (in.)
   ASPECT RATIO                AR         0.20000E+01
   MAXIMUM TEMPERATURE         TMAX       0.29550E+04   (R)
   BLADE ROOT ANGLE            THER       0.00000E+00   (deg.)
   STAGE LENGTH                STL        0.45000E+01   (in.)
   BLADE BROACH ANGLE          BRANG      0.00000E+00   (deg.)
   BLADE STAGGER ANGLE         STAGG      0.35000E+02   (deg.)
   1ST STATION CHORD LENGTH    CHORD(1)   0.12700E+01   (in.)
   STAGE PRESSURE RATIO        PR         0.25900E+01
   STAGE PRESSURE              STAGEP     0.41786E+05   (lb/ft^2)
   STAGE TEMPERATURE           STAGET     0.26964E+04   (R)
   STAGE MASS FLOW RATE        STAGEF     0.38400E+03   (lb/sec)
   BLADE MATERIAL              MATSLC   STAINLESS STEEL
   AIRFOIL DEFINITION          AIRCODE  NACA 64-206 TURBINE
   FULL BLADE DEFINITION       ABLDEF
   BLADE UNTWIST               UTWIST    -0.20370E+00   (deg.)
   BLADE UNCAMBER              UCAMB      0.30000E-02   (deg.)
   MAXIMUM TIP EXTENSION       TIPX       0.14000E-02   (in.)
   MAX. IN PLANE Y-DISPL.      TIPY       0.24500E-01   (in.)
   MAX. IN PLANE Z-DISPL.      TIPZ       0.90000E-03   (in.)
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FREQUENCY AT MIN. CRUISE	WMC1	0.51861E+03	(cps) MODE 1
FREQUENCY AT ROTOR SPEED	w1	0.56606E+03	(cps) MODE 1
FREQUENCY AT MAX. SPEED	WRL1	0.61531E+03	(cps) MODE 1
MAXIMUM RESONANCE MARGIN	MAXMR11	0.32994E+01	EXCIT. ORDER 1
MAXIMUM RESONANCE MARGIN	MAXMR12	0.11497E+01	EXCIT. ORDER 2
MAXIMUM RESONANCE MARGIN	MAXMR13	0.43312E+00	EXCIT. ORDER 3
MAXIMUM RESONANCE MARGIN	MAXMR14	0.74840E-01	EXCIT. ORDER 4
MAXIMUM RESONANCE MARGIN	MAXMR15	0.72393E-01	EXCIT. ORDER 5
FREQUENCY AT MIN. CRUISE	WMC2	0.13848E+04	(cps) MODE 2
FREQUENCY AT ROTOR SPEED	w2	0.14017E+04	(cps) MODE 2
FREQUENCY AT MAX. SPEED	WRL2	0.14206E+04	(cps) MODE 2
MAXIMUM RESONANCE MARGIN	MAXMR21	0.89261E+01	EXCIT. ORDER 1
MAXIMUM RESONANCE MARGIN	MAXMR22	0.39630E+01	EXCIT. ORDER 2
MAXIMUM RESONANCE MARGIN	MAXMR23	0.23087E+01	EXCIT. ORDER 3
MAXIMUM RESONANCE MARGIN	MAXMR24	0.14815E+01	EXCIT. ORDER 4
MAXIMUM RESONANCE MARGIN	MAXMR25	0.98521E+00	EXCIT. ORDER 5
FREQUENCY AT MIN. CRUISE	WMC3	0.21170E+04	(cps) MODE 3
FREQUENCY AT ROTOR SPEED	w3	0.21797E+04	(cps) MODE 3
FREQUENCY AT MAX. SPEED	WRL3	0.22486E+04	(cps) MODE 3
MAXIMUM RESONANCE MARGIN	MAXMR31	0.14711E+02	EXCIT. ORDER 1
MAXIMUM RESONANCE MARGIN	MAXMR32	0.68557E+01	EXCIT. ORDER 2
MAXIMUM RESONANCE MARGIN	MAXMR33	0.42371E+01	EXCIT. ORDER 3
MAXIMUM RESONANCE MARGIN	MAXMR34	0.29278E+01	EXCIT. ORDER 4
MAXIMUM RESONANCE MARGIN	MAXMR35	0.21423E+01	EXCIT. ORDER 5
FREQUENCY AT MIN. CRUISE	WMC4	0.42522E+04	(cps) MODE 4
FREQUENCY AT ROTOR SPEED	w4	0.42839E+04	(cps) MODE 4
FREQUENCY AT MAX. SPEED	WRL4	0.43195E+04	(cps) MODE 4
MAXIMUM RESONANCE MARGIN	MAXMR41	0.29182E+02	EXCIT. ORDER 1
MAXIMUM RESONANCE MARGIN	MAXMR42	0.14091E+02	EXCIT. ORDER 2
MAXIMUM RESONANCE MARGIN	MAXMR43	0.90606E+01	EXCIT. ORDER 3
MAXIMUM RESONANCE MARGIN	MAXMR44	0.65455E+01	EXCIT. ORDER 4
MAXIMUM RESONANCE MARGIN	MAXMR45	0.50364E+01	EXCIT. ORDER 5
FREQUENCY AT MIN. CRUISE	WMC5	0.51957E+04	(cps) MODE 5
FREQUENCY AT ROTOR SPEED	w5	0.52004E+04	(cps) MODE 5
FREQUENCY AT MAX. SPEED	WRL5	0.52056E+04	(cps) MODE 5
MAXIMUM RESONANCE MARGIN	MAXMR51	0.35373E+02	EXCIT. ORDER 1
MAXIMUM RESONANCE MARGIN	MAXMR52	0.17187E+02	EXCIT. ORDER 2
MAXIMUM RESONANCE MARGIN	MAXMR53	0.11124E+02	EXCIT. ORDER 3
MAXIMUM RESONANCE MARGIN	MAXMR54	0.80933E+01	EXCIT. ORDER 4
MAXIMUM RESONANCE MARGIN	MAXMR55	0.62746E+01	EXCIT. ORDER 5
MAX. MARGIN GOODMAN DIAG.	PMODE1	0.10000E+01	FINITE LIFE IF PMODE > 1.
MAX. MARGIN GOODMAN DIAG.	PMODE2	0.83920E+00	FINITE LIFE IF PMODE > 1.
MAX. MARGIN GOODMAN DIAG.	PMODE3	0.54380E+00	FINITE LIFE IF PMODE > 1.
MAX. MARGIN GOODMAN DIAG.	PMODE4	0.10000E+01	FINITE LIFE IF PMODE > 1.
MAX. MARGIN GOODMAN DIAG.	PMODE5	0.83920E+00	FINITE LIFE IF PMODE > 1.
ROOT STRESS	RSTRES	0.40528E+05	(psi)
MDE BLADE ROOT RESPONSE	FROOT	0.47423E-01	FAILURE IF FUNCTION > 1.
BLADE WEIGHT	WGHT	0.54960E-01	(lbs)
FOREIGN OBJECT VELOCITY	VELFOD	0.00000E+00	(knots)
FOREIGN OBJECT RADIUS	RADFOD	0.00000E+00	(in.)
IMPACT ANGLE	ANGFOD	0.00000E+00	(deg.)
STAGGER ANGLE AT IMPACT	STAFOD	0.00000E+00	(deg.)
FOREIGN OBJECT DENSITY	DENFOD	0.00000E+00	(lbm.sec^2/in^4)
IMPACT MAX. EDGE STRAIN	STRAIN	0.00000E+00	(%)
IMPACT ROOT DAMAGE	ROOTD	0.00000E+00	FAILURE IF FUNCTION > 1.
EFFICIENCY (KINETIC)	EFNCY	0.74310E+00	
PROFILE EFFICIENCY	EPROF	0.15900E-01	
ENDWALL EFFICIENCY	ENDWA	0.18500E-01	
SEC. LOSS EFFICIENCY	ESECL	0.60000E-02	
INCIDENCE EFFICIENCY	EINCD	0.17090E+00	
CLEARANCE EFFICIENCY	ECLEA	0.45600E-01	
WINDAGE EFFICIENCY	EWIND	0.00000E+00	

Listing of "*neutral.file*" (Continued)

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    SUM ROTOR EFFICIENCY         ESUMR       0.25690E+00
    PROCESS                      TYPROC     MAURER
    STOCK MATERIAL WEIGHT        SWGHT       0.00000E+00   (lbs)
    MAURER WEIGHT FACTOR         MAURER      0.00000E+00   (lbs)
    COST TO MANUFACTURE ONE      COST1       0.00000E+00   ($)
    DISK MATERIAL                DISMAT     STAINLESS STEEL
    DISK WEIGHT                  DWGHT       0.00000E+00   (lbs)
    PROCESS                      TYPROC     MAURER
    STOCK MATERIAL WEIGHT        DSWGHT      0.00000E+00   (lbs)
    MAURER WEIGHT FACTOR         MAURER      0.00000E+00   (lbs)
    COST TO MANUFACTURE ONE      COST1       0.00000E+00   ($)
    TOTAL STAGE COST             COSTT       0.00000E+00   ($)
    TOTAL WEIGHT                 TWGHT       0.57000E+03   (lbs)
    TOTAL COST                   TCOST       0.00000E+00   ($)
ENGINE COMPONENT TYPE: LPT       NCC           9
NUMBER OF STAGES                 NSTAGE        2
MINIMUM CRUISE SPEED             RPMCR       0.61060E+04
ROTOR SPEED                      RPM         0.61060E+04
MAXIMUM ROTOR SPEED              RPMAX       0.61060E+04
BLADE TAPER RATIO (HUB/TIP)      TR          0.10000E+01
UPSTREAM HUB RADIUS              RIUP1       0.20000E+02   (in.)
DOWNSTREAM HUB RADIUS            RIDW1       0.18000E+02   (in.)
UPSTREAM SHROUD RADIUS           ROUP1       0.24000E+02   (in.)
  STAGE NUMBER                   NS            1
   NUMBER OF BLADES              NB           99
   STAGE WEIGHT                  NSTW        0.31000E+03   (lbs)
   HUB RADIUS                    RHBA        0.19900E+02   (in.)
   TIP RADIUS                    RTBA        0.23860E+02   (in.)
   ASPECT RATIO                  AR          0.25000E+01
   MAXIMUM TEMPERATURE           TMAX        0.23120E+04   (R)
   BLADE ROOT ANGLE              THER       -0.87462E+01   (deg.)
   STAGE LENGTH                  STL         0.56000E+01   (in.)
   BLADE BROACH ANGLE            BRANG       0.00000E+00   (deg.)
   BLADE STAGGER ANGLE           STAGG       0.35000E+02   (deg.)
   1ST STATION CHORD LENGTH      CHORD(1)    0.15840E+01   (in.)
   STAGE PRESSURE RATIO          PR          0.14700E+01
   STAGE PRESSURE                STAGEP      0.16117E+05   (lb/ft^2)
   STAGE TEMPERATURE             STAGET      0.21305E+04   (R)
   STAGE MASS FLOW RATE          STAGEF      0.43410E+03   (lb/sec)
   BLADE MATERIAL                MATSLC     STAINLESS STEEL
   AIRFOIL DEFINITION            AIRCODE    NACA 64-206 TURBINE
   FULL BLADE DEFINITION         ABLDEF
   BLADE UNTWIST                 UTWIST     -0.36150E+00   (deg.)
   BLADE UNCAMBER                UCAMB       0.14700E-01   (deg.)
   MAXIMUM TIP EXTENSION         TIPX        0.21000E-02   (in.)
   MAX. IN PLANE Y-DISPL.        TIPY        0.42700E-01   (in.)
   MAX. IN PLANE Z-DISPL.        TIPZ        0.15000E-02   (in.)
   FREQUENCY AT MIN. CRUISE      WMC1        0.34527E+03   (cps) MODE 1
   FREQUENCY AT ROTOR SPEED      w1          0.34528E+03   (cps) MODE 1
   FREQUENCY AT MAX. SPEED       WRL1        0.34527E+03   (cps) MODE 1
   MAXIMUM RESONANCE MARGIN      MAXMR11     0.23928E+01   EXCIT. ORDER 1
   MAXIMUM RESONANCE MARGIN      MAXMR12     0.69640E+00   EXCIT. ORDER 2
   MAXIMUM RESONANCE MARGIN      MAXMR13     0.13094E+00   EXCIT. ORDER 3
   MAXIMUM RESONANCE MARGIN      MAXMR14     0.15180E+00   EXCIT. ORDER 4
   MAXIMUM RESONANCE MARGIN      MAXMR15     0.32144E+00   EXCIT. ORDER 5
   FREQUENCY AT MIN. CRUISE      WMC2        0.87355E+03   (cps) MODE 2
   FREQUENCY AT ROTOR SPEED      w2          0.87356E+03   (cps) MODE 2
   FREQUENCY AT MAX. SPEED       WRL2        0.87355E+03   (cps) MODE 2
   MAXIMUM RESONANCE MARGIN      MAXMR21     0.75839E+01   EXCIT. ORDER 1
   MAXIMUM RESONANCE MARGIN      MAXMR22     0.32919E+01   EXCIT. ORDER 2
   MAXIMUM RESONANCE MARGIN      MAXMR23     0.18613E+01   EXCIT. ORDER 3
   MAXIMUM RESONANCE MARGIN      MAXMR24     0.11460E+01   EXCIT. ORDER 4
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Listing of "*neutral.file*" (Continued)

MAXIMUM RESONANCE MARGIN	MAXMR25	0.71678E+00	EXCIT. ORDER 5
FREQUENCY AT MIN. CRUISE	WMC3	0.12057E+04	(cps) MODE 3
FREQUENCY AT ROTOR SPEED	w3	0.12058E+04	(cps) MODE 3
FREQUENCY AT MAX. SPEED	WRL3	0.12057E+04	(cps) MODE 3
MAXIMUM RESONANCE MARGIN	MAXMR31	0.10848E+02	EXCIT. ORDER 1
MAXIMUM RESONANCE MARGIN	MAXMR32	0.49240E+01	EXCIT. ORDER 2
MAXIMUM RESONANCE MARGIN	MAXMR33	0.29493E+01	EXCIT. ORDER 3
MAXIMUM RESONANCE MARGIN	MAXMR34	0.19620E+01	EXCIT. ORDER 4
MAXIMUM RESONANCE MARGIN	MAXMR35	0.13696E+01	EXCIT. ORDER 5
FREQUENCY AT MIN. CRUISE	WMC4	0.26815E+04	(cps) MODE 4
FREQUENCY AT ROTOR SPEED	w4	0.26815E+04	(cps) MODE 4
FREQUENCY AT MAX. SPEED	WRL4	0.26815E+04	(cps) MODE 4
MAXIMUM RESONANCE MARGIN	MAXMR41	0.25350E+02	EXCIT. ORDER 1
MAXIMUM RESONANCE MARGIN	MAXMR42	0.12175E+02	EXCIT. ORDER 2
MAXIMUM RESONANCE MARGIN	MAXMR43	0.77832E+01	EXCIT. ORDER 3
MAXIMUM RESONANCE MARGIN	MAXMR44	0.55874E+01	EXCIT. ORDER 4
MAXIMUM RESONANCE MARGIN	MAXMR45	0.42699E+01	EXCIT. ORDER 5
FREQUENCY AT MIN. CRUISE	WMC5	0.27969E+04	(cps) MODE 5
FREQUENCY AT ROTOR SPEED	w5	0.27969E+04	(cps) MODE 5
FREQUENCY AT MAX. SPEED	WRL5	0.27969E+04	(cps) MODE 5
MAXIMUM RESONANCE MARGIN	MAXMR51	0.26483E+02	EXCIT. ORDER 1
MAXIMUM RESONANCE MARGIN	MAXMR52	0.12742E+02	EXCIT. ORDER 2
MAXIMUM RESONANCE MARGIN	MAXMR53	0.81611E+01	EXCIT. ORDER 3
MAXIMUM RESONANCE MARGIN	MAXMR54	0.58708E+01	EXCIT. ORDER 4
MAXIMUM RESONANCE MARGIN	MAXMR55	0.44967E+01	EXCIT. ORDER 5
MAX. MARGIN GOODMAN DIAG.	PMODE1	0.10000E+01	FINITE LIFE IF PMODE > 1.
MAX. MARGIN GOODMAN DIAG.	PMODE2	0.83960E+00	FINITE LIFE IF PMODE > 1.
MAX. MARGIN GOODMAN DIAG.	PMODE3	0.54320E+00	FINITE LIFE IF PMODE > 1.
MAX. MARGIN GOODMAN DIAG.	PMODE4	0.10000E+01	FINITE LIFE IF PMODE > 1.
MAX. MARGIN GOODMAN DIAG.	PMODE5	0.83960E+00	FINITE LIFE IF PMODE > 1.
ROOT STRESS	RSTRES	0.39928E+05	(psi)
MDE BLADE ROOT RESPONSE	FROOT	0.48663E-01	FAILURE IF FUNCTION > 1.
BLADE WEIGHT	WGHT	0.13242E+00	(lbs)
FOREIGN OBJECT VELOCITY	VELFOD	0.00000E+00	(knots)
FOREIGN OBJECT RADIUS	RADFOD	0.00000E+00	(in.)
IMPACT ANGLE	ANGFOD	0.00000E+00	(deg.)
STAGGER ANGLE AT IMPACT	STAFOD	0.00000E+00	(deg.)
FOREIGN OBJECT DENSITY	DENFOD	0.00000E+00	(lbm.sec^2/in^4)
IMPACT MAX. EDGE STRAIN	STRAIN	0.00000E+00	(%)
IMPACT ROOT DAMAGE	ROOTD	0.00000E+00	FAILURE IF FUNCTION > 1.
EFFICIENCY (KINETIC)	EFNCY	0.89650E+00	
PROFILE EFFICIENCY	EPROF	0.25500E-01	
ENDWALL EFFICIENCY	ENDWA	0.15300E-01	
SEC. LOSS EFFICIENCY	ESECL	0.80000E-03	
INCIDENCE EFFICIENCY	EINCD	0.35300E-01	
CLEARANCE EFFICIENCY	ECLEA	0.26500E-01	
WINDAGE EFFICIENCY	EWIND	0.00000E+00	
SUM ROTOR EFFICIENCY	ESUMR	0.10350E+00	
PROCESS	TYPROC	MAURER	
STOCK MATERIAL WEIGHT	SWGHT	0.00000E+00	(lbs)
MAURER WEIGHT FACTOR	MAURER	0.00000E+00	(lbs)
COST TO MANUFACTURE ONE	COST1	0.00000E+00	($)
DISK MATERIAL	DISMAT	STAINLESS STEEL	
DISK WEIGHT	DWGHT	0.00000E+00	(lbs)
PROCESS	TYPROC	MAURER	
STOCK MATERIAL WEIGHT	DSWGHT	0.00000E+00	(lbs)
MAURER WEIGHT FACTOR	MAURER	0.00000E+00	(lbs)
COST TO MANUFACTURE ONE	COST1	0.00000E+00	($)
TOTAL STAGE COST	COSTT	0.00000E+00	($)
STAGE NUMBER	NS	2	
NUMBER OF BLADES	NB	108	
STAGE WEIGHT	NSTW	0.51000E+03	(lbs)

Listing of "*neutral.file*" (Continued)

HUB RADIUS	RHBA	0.19260E+02	(in.)
TIP RADIUS	RTBA	0.24500E+02	(in.)
ASPECT RATIO	AR	0.35000E+01	
MAXIMUM TEMPERATURE	TMAX	0.23120E+04	(R)
BLADE ROOT ANGLE	THER	-0.87462E+01	(deg.)
STAGE LENGTH	STL	0.52000E+01	(in.)
BLADE BROACH ANGLE	BRANG	0.00000E+00	(deg.)
BLADE STAGGER ANGLE	STAGG	0.35000E+02	(deg.)
1ST STATION CHORD LENGTH	CHORD(1)	0.14971E+01	(in.)
STAGE PRESSURE RATIO	PR	0.15200E+01	
STAGE PRESSURE	STAGEP	0.10964E+05	(lb/ft^2)
STAGE TEMPERATURE	STAGET	0.21305E+04	(R)
STAGE MASS FLOW RATE	STAGEF	0.43410E+03	(lb/sec)
BLADE MATERIAL	MATSLC	STAINLESS STEEL	
AIRFOIL DEFINITION	AIRCODE	NACA 64-206 TURBINE	
FULL BLADE DEFINITION	ABLDEF		
BLADE UNTWIST	UTWIST	-0.81030E+00	(deg.)
BLADE UNCAMBER	UCAMB	0.42000E-02	(deg.)
MAXIMUM TIP EXTENSION	TIPX	0.39000E-02	(in.)
MAX. IN PLANE Y-DISPL.	TIPY	0.14120E+00	(in.)
MAX. IN PLANE Z-DISPL.	TIPZ	0.50000E-02	(in.)
FREQUENCY AT MIN. CRUISE	WMC1	0.27800E+03	(cps) MODE 1
FREQUENCY AT ROTOR SPEED	w1	0.27801E+03	(cps) MODE 1
FREQUENCY AT MAX. SPEED	WRL1	0.27800E+03	(cps) MODE 1
MAXIMUM RESONANCE MARGIN	MAXMR11	0.17317E+01	EXCIT. ORDER 1
MAXIMUM RESONANCE MARGIN	MAXMR12	0.36586E+00	EXCIT. ORDER 2
MAXIMUM RESONANCE MARGIN	MAXMR13	0.89426E-01	EXCIT. ORDER 3
MAXIMUM RESONANCE MARGIN	MAXMR14	0.31707E+00	EXCIT. ORDER 4
MAXIMUM RESONANCE MARGIN	MAXMR15	0.45366E+00	EXCIT. ORDER 5
FREQUENCY AT MIN. CRUISE	WMC2	0.65480E+03	(cps) MODE 2
FREQUENCY AT ROTOR SPEED	w2	0.65480E+03	(cps) MODE 2
FREQUENCY AT MAX. SPEED	WRL2	0.65480E+03	(cps) MODE 2
MAXIMUM RESONANCE MARGIN	MAXMR21	0.54343E+01	EXCIT. ORDER 1
MAXIMUM RESONANCE MARGIN	MAXMR22	0.22172E+01	EXCIT. ORDER 2
MAXIMUM RESONANCE MARGIN	MAXMR23	0.11448E+01	EXCIT. ORDER 3
MAXIMUM RESONANCE MARGIN	MAXMR24	0.60858E+00	EXCIT. ORDER 4
MAXIMUM RESONANCE MARGIN	MAXMR25	0.28687E+00	EXCIT. ORDER 5
FREQUENCY AT MIN. CRUISE	WMC3	0.81938E+03	(cps) MODE 3
FREQUENCY AT ROTOR SPEED	w3	0.81940E+03	(cps) MODE 3
FREQUENCY AT MAX. SPEED	WRL3	0.81938E+03	(cps) MODE 3
MAXIMUM RESONANCE MARGIN	MAXMR31	0.70516E+01	EXCIT. ORDER 1
MAXIMUM RESONANCE MARGIN	MAXMR32	0.30258E+01	EXCIT. ORDER 2
MAXIMUM RESONANCE MARGIN	MAXMR33	0.16839E+01	EXCIT. ORDER 3
MAXIMUM RESONANCE MARGIN	MAXMR34	0.10129E+01	EXCIT. ORDER 4
MAXIMUM RESONANCE MARGIN	MAXMR35	0.61031E+00	EXCIT. ORDER 5
FREQUENCY AT MIN. CRUISE	WMC4	0.16339E+04	(cps) MODE 4
FREQUENCY AT ROTOR SPEED	w4	0.16339E+04	(cps) MODE 4
FREQUENCY AT MAX. SPEED	WRL4	0.16339E+04	(cps) MODE 4
MAXIMUM RESONANCE MARGIN	MAXMR41	0.15056E+02	EXCIT. ORDER 1
MAXIMUM RESONANCE MARGIN	MAXMR42	0.70279E+01	EXCIT. ORDER 2
MAXIMUM RESONANCE MARGIN	MAXMR43	0.43519E+01	EXCIT. ORDER 3
MAXIMUM RESONANCE MARGIN	MAXMR44	0.30140E+01	EXCIT. ORDER 4
MAXIMUM RESONANCE MARGIN	MAXMR45	0.22112E+01	EXCIT. ORDER 5
FREQUENCY AT MIN. CRUISE	WMC5	0.18060E+04	(cps) MODE 5
FREQUENCY AT ROTOR SPEED	w5	0.18060E+04	(cps) MODE 5
FREQUENCY AT MAX. SPEED	WRL5	0.18060E+04	(cps) MODE 5
MAXIMUM RESONANCE MARGIN	MAXMR51	0.16747E+02	EXCIT. ORDER 1
MAXIMUM RESONANCE MARGIN	MAXMR52	0.78733E+01	EXCIT. ORDER 2
MAXIMUM RESONANCE MARGIN	MAXMR53	0.49156E+01	EXCIT. ORDER 3
MAXIMUM RESONANCE MARGIN	MAXMR54	0.34367E+01	EXCIT. ORDER 4
MAXIMUM RESONANCE MARGIN	MAXMR55	0.25493E+01	EXCIT. ORDER 5
MAX. MARGIN GOODMAN DIAG.	PMODE1	0.10000E+01	FINITE LIFE IF PMODE > 1.

MAX. MARGIN GOODMAN DIAG.	PMODE2	0.83970E+00	FINITE LIFE IF PMODE > 1.
MAX. MARGIN GOODMAN DIAG.	PMODE3	0.54300E+00	FINITE LIFE IF PMODE > 1.
MAX. MARGIN GOODMAN DIAG.	PMODE4	0.10000E+01	FINITE LIFE IF PMODE > 1.
MAX. MARGIN GOODMAN DIAG.	PMODE5	0.83970E+00	FINITE LIFE IF PMODE > 1.
ROOT STRESS	RSTRES	0.58838E+05	(psi)
MDE BLADE ROOT RESPONSE	FROOT	0.10503E+00	FAILURE IF FUNCTION > 1.
BLADE WEIGHT	WGHT	0.15733E+00	(lbs)
FOREIGN OBJECT VELOCITY	VELFOD	0.00000E+00	(knots)
FOREIGN OBJECT RADIUS	RADFOD	0.00000E+00	(in.)
IMPACT ANGLE	ANGFOD	0.00000E+00	(deg.)
STAGGER ANGLE AT IMPACT	STAFOD	0.00000E+00	(deg.)
FOREIGN OBJECT DENSITY	DENFOD	0.00000E+00	(lbm.sec^2/in^4)
IMPACT MAX. EDGE STRAIN	STRAIN	0.00000E+00	(%)
IMPACT ROOT DAMAGE	ROOTD	0.00000E+00	FAILURE IF FUNCTION > 1.
EFFICIENCY (KINETIC)	EFNCY	0.91000E+00	
PROFILE EFFICIENCY	EPROF	0.27900E-01	
ENDWALL EFFICIENCY	ENDWA	0.16000E-01	
SEC. LOSS EFFICIENCY	ESECL	0.00000E+00	
INCIDENCE EFFICIENCY	EINCD	0.22500E-01	
CLEARANCE EFFICIENCY	ECLEA	0.23400E-01	
WINDAGE EFFICIENCY	EWIND	0.00000E+00	
SUM ROTOR EFFICIENCY	ESUMR	0.90000E-01	
PROCESS	TYPROC	MAURER	
STOCK MATERIAL WEIGHT	SWGHT	0.00000E+00	(lbs)
MAURER WEIGHT FACTOR	MAURER	0.00000E+00	(lbs)
COST TO MANUFACTURE ONE	COST1	0.00000E+00	($)
DISK MATERIAL	DISMAT	STAINLESS STEEL	
DISK WEIGHT	DWGHT	0.00000E+00	(lbs)
PROCESS	TYPROC	MAURER	
STOCK MATERIAL WEIGHT	DSWGHT	0.00000E+00	(lbs)
MAURER WEIGHT FACTOR	MAURER	0.00000E+00	(lbs)
COST TO MANUFACTURE ONE	COST1	0.00000E+00	($)
TOTAL STAGE COST	COSTT	0.00000E+00	($)
TOTAL WEIGHT	TWGHT	0.12115E+04	(lbs)
TOTAL COST	TCOST	0.00000E+00	($)
ENGINE COMPONENT TYPE: INLE	NCC	1	
MATERIAL	CMPMAT	ALUMINUM	
PROCESS	TYPROC	MAURER	
INLE WEIGHT	WGHT	0.00000E+00	(lbs)
STOCK MATERIAL WEIGHT	SWGHT	0.00000E+00	(lbs)
MAURER WEIGHT FACTOR	MAURER	0.00000E+00	(lbs)
COST TO MANUFACTURE ONE	COST1	0.00000E+00	($)
INNER RADIUS	RIN	0.00000E+00	(in.)
OUTER RADIUS	ROUT	0.00000E+00	(in.)
COMPONENT LENGTH	LENGTH	0.00000E+00	(in.)
ENGINE COMPONENT TYPE: DUCT	NCC	4	
MATERIAL	CMPMAT	STAINLESS STEEL	
PROCESS	TYPROC	MAURER	
DUCT WEIGHT	WGHT	0.17200E+02	(lbs)
STOCK MATERIAL WEIGHT	SWGHT	0.00000E+00	(lbs)
MAURER WEIGHT FACTOR	MAURER	0.00000E+00	(lbs)
COST TO MANUFACTURE ONE	COST1	0.00000E+00	($)
INNER RADIUS	RIN	0.23720E+02	(in.)
OUTER RADIUS	ROUT	0.27560E+02	(in.)
COMPONENT LENGTH	LENGTH	0.96000E+01	(in.)
ENGINE COMPONENT TYPE: DUCT	NCC	6	
MATERIAL	CMPMAT	STAINLESS STEEL	
PROCESS	TYPROC	MAURER	
DUCT WEIGHT	WGHT	0.51000E+02	(lbs)
STOCK MATERIAL WEIGHT	SWGHT	0.00000E+00	(lbs)
MAURER WEIGHT FACTOR	MAURER	0.00000E+00	(lbs)
COST TO MANUFACTURE ONE	COST1	0.00000E+00	($)

Listing of "*neutral.file*" (Continued)

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   INNER RADIUS                  RIN        0.20540E+02   (in.)
   OUTER RADIUS                  ROUT       0.21640E+02   (in.)
   COMPONENT LENGTH              LENGTH     0.64000E+01   (in.)
ENGINE COMPONENT TYPE: PBUR      NCC          7
   MATERIAL                      CMPMAT    NICKEL
   PROCESS                       TYPROC    MAURER
   PBUR WEIGHT                   WGHT       0.62030E+03   (lbs)
   STOCK MATERIAL WEIGHT         SWGHT      0.00000E+00   (lbs)
   MAURER WEIGHT FACTOR          MAURER     0.00000E+00   (lbs)
   COST TO MANUFACTURE ONE       COST1      0.00000E+00   ($)
   INNER RADIUS                  RIN        0.19510E+02   (in.)
   OUTER RADIUS                  ROUT       0.22560E+02   (in.)
   COMPONENT LENGTH              LENGTH     0.18000E+02   (in.)
   NUMBER OF NOZZLES             NCNOZZ       4
   COMBUSTOR THICKNESS           CTHK       0.10000E+00   (in.)
ENGINE COMPONENT TYPE: DUCT      NCC         10
   MATERIAL                      CMPMAT    STAINLESS STEEL
   PROCESS                       TYPROC    MAURER
   DUCT WEIGHT                   WGHT       0.00000E+00   (lbs)
   STOCK MATERIAL WEIGHT         SWGHT      0.00000E+00   (lbs)
   MAURER WEIGHT FACTOR          MAURER     0.00000E+00   (lbs)
   COST TO MANUFACTURE ONE       COST1      0.00000E+00   ($)
   INNER RADIUS                  RIN        0.00000E+00   (in.)
   OUTER RADIUS                  ROUT       0.00000E+00   (in.)
   COMPONENT LENGTH              LENGTH     0.18000E+02   (in.)
ENGINE COMPONENT TYPE: FMIX      NCC         11
   MATERIAL                      CMPMAT    STAINLESS STEEL
   PROCESS                       TYPROC    MAURER
   FMIX WEIGHT                   WGHT       0.12360E+03   (lbs)
   STOCK MATERIAL WEIGHT         SWGHT      0.00000E+00   (lbs)
   MAURER WEIGHT FACTOR          MAURER     0.00000E+00   (lbs)
   COST TO MANUFACTURE ONE       COST1      0.00000E+00   ($)
   INNER RADIUS                  RIN        0.00000E+00   (in.)
   OUTER RADIUS                  ROUT       0.00000E+00   (in.)
   COMPONENT LENGTH              LENGTH     0.17900E+02   (in.)
ENGINE COMPONENT TYPE: AUG       NCC         12
   MATERIAL                      CMPMAT    STAINLESS STEEL
   PROCESS                       TYPROC    MAURER
   AUG  WEIGHT                   WGHT       0.00000E+00   (lbs)
   STOCK MATERIAL WEIGHT         SWGHT      0.00000E+00   (lbs)
   MAURER WEIGHT FACTOR          MAURER     0.00000E+00   (lbs)
   COST TO MANUFACTURE ONE       COST1      0.00000E+00   ($)
   INNER RADIUS                  RIN        0.00000E+00   (in.)
   OUTER RADIUS                  ROUT       0.26340E+02   (in.)
   COMPONENT LENGTH              LENGTH     0.00000E+00   (in.)
ENGINE COMPONENT TYPE: NOZ       NCC         13
   MATERIAL                      CMPMAT    STAINLESS STEEL
   PROCESS                       TYPROC    MAURER
   NOZ  WEIGHT                   WGHT       0.34220E+04   (lbs)
   STOCK MATERIAL WEIGHT         SWGHT      0.00000E+00   (lbs)
   MAURER WEIGHT FACTOR          MAURER     0.00000E+00   (lbs)
   COST TO MANUFACTURE ONE       COST1      0.00000E+00   ($)
   INNER RADIUS                  RIN        0.00000E+00   (in.)
   OUTER RADIUS                  ROUT       0.00000E+00   (in.)
   COMPONENT LENGTH              LENGTH     0.23510E+03   (in.)
ENGINE COMPONENT TYPE: DUCT      NCC         14
   MATERIAL                      CMPMAT    STAINLESS STEEL
   PROCESS                       TYPROC    MAURER
   DUCT WEIGHT                   WGHT       0.15350E+03   (lbs)
   STOCK MATERIAL WEIGHT         SWGHT      0.00000E+00   (lbs)
   MAURER WEIGHT FACTOR          MAURER     0.00000E+00   (lbs)
   COST TO MANUFACTURE ONE       COST1      0.00000E+00   ($)
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     INNER RADIUS                    RIN        0.27530E+02   (in.)
     OUTER RADIUS                    ROUT       0.29430E+02   (in.)
     COMPONENT LENGTH                LENGTH     0.72200E+02   (in.)
  ENGINE COMPONENT TYPE: SHAF        NCC         17
     MATERIAL                        CMPMAT     STAINLESS STEEL
     PROCESS                         TYPROC     MAURER
     SHAF WEIGHT                     WGHT       0.18270E+03   (lbs)
     STOCK MATERIAL WEIGHT           SWGHT      0.00000E+00   (lbs)
     MAURER WEIGHT FACTOR            MAURER     0.00000E+00   (lbs)
     COST TO MANUFACTURE ONE         COST1      0.00000E+00   ($)
     INNER RADIUS                    RIN        0.00000E+00   (in.)
     OUTER RADIUS                    ROUT       0.20350E+01   (in.)
     COMPONENT LENGTH                LENGTH     0.58660E+02   (in.)
     SHAFT DN                        DN         0.63000E+00
  ENGINE COMPONENT TYPE: SHAF        NCC         16
     MATERIAL                        CMPMAT     STAINLESS STEEL
     PROCESS                         TYPROC     MAURER
     SHAF WEIGHT                     WGHT       0.35200E+02   (lbs)
     STOCK MATERIAL WEIGHT           SWGHT      0.00000E+00   (lbs)
     MAURER WEIGHT FACTOR            MAURER     0.00000E+00   (lbs)
     COST TO MANUFACTURE ONE         COST1      0.00000E+00   ($)
     INNER RADIUS                    RIN        0.22350E+01   (in.)
     OUTER RADIUS                    ROUT       0.26250E+01   (in.)
     COMPONENT LENGTH                LENGTH     0.24350E+02   (in.)
     SHAFT DN                        DN         0.11500E+01
  GLOBAL VARIABLES 1 - AIRCRAFT - DOC
    AIRCRAFT GROSS WEIGHT            GW         0.59696E+06   (lbs.)
    AIRFRAME WEIGHT                  AW         0.24832E+06   (lbs.)
    CAPACITY WEIGHT                  CW         0.16195E+06   (lbs.)
    FUEL WEIGHT                      FW         0.15659E+06   (lbs.)
    CAPACITY+FUEL WEIGHT             TW         0.31854E+06   (lbs.)
    WEIGHT OF BARE ENGINE            EN         0.11705E+05   (lbs.)
    WEIGHT OF ENGINE ACESSORIES      EA         0.76900E+03   (lbs.)
    ESTIMATED TOTAL LENGTH           TLEN       0.36100E+03   (in.)
    ESTIMATED MAXIMUM RADIUS         RADMAX     0.35200E+02   (in.)
    NUMBER OF ENGINES                NE          4
    LANDING WEIGHT                   WFF        0.00000E+00   (lbs.)
    AIRCRAFT LIFT/DRAG RATIO         ALD        0.15810E+02
  GLOBAL VARIABLES 2 - NOISE
    1ST STAGE WEIGHT FLOW RATE       XFLOW      0.69393E+03   (lbs/sec)
    1ST STAG RELATIVE TIP SPEED      XVR        0.16500E+04   (ft/sec)
    1ST STAGE ROTATIVE RPM           XRPM       0.61060E+04   (RPM)
    1ST STA. ROT-STAT AXIAL GAP      XGAP       0.23630E+01   (in.)
    1ST ROT-STA TIP AXIAL CHORD      XCHORD     0.64000E+01   (in.)
    INLET FLOW AREA                  XAF        0.00000E+00   (sq. ft)
    AFT DUCT AREA                    XAR        0.00000E+00   (sq. ft.)
    NOZZLE INNER RADIUS              RI         0.24000E+02   (ft.)
    NOZZLE OUTER RADIUS              RO         0.29000E+02   (ft.)
    NOZZLE (PASSAGE) HEIGHT          XAH        0.00000E+00   (in.)
    TEMPERATURE                      XT         0.59000E+02   (F)
    RELATIVE HUMIDITY                XRH        0.70000E+02   (%)
    SIDELINE DISTANCE                XDIST      0.50000E+03   (ft.)
    TARGET PERCEIVED NOISE LEV.      XPNL       0.90000E+02   (PNdB)
    50 DEG.PERCEIVED NOISE LEV.      XPNDBF     0.15326E+03   (PNdB)
    120DEG.PERCEIVED NOISE LEV.      XPNDBR     0.16074E+03   (PNdB)
  GLOBAL VARIABLES 3 - MISSION
    ALTITUDE                         CALT       0.60000E+05   (ft.)
      SPEED                          V          0.24000E+01   (MACH No.)
      GROSS THRUST                   AT         0.40595E+05   (lbst)
      INSTALLED THRUST               ATI        0.15428E+05   (lbst)
      SPECIFIC FUEL CONSUMPT.        SFC        0.12320E+01   (lb/lbt/hr)
      JET VELOCITY                   XVJ        0.37708E+04   (ft/sec)
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Listing of "*neutral.file*" (Continued)

COMPONENT TYPE: FAN	NCC	2	
STATION NUMBER AT INLET	STIDIN	2	
PRESSURE AT INLET	PFAN1	0.13697E+02	(psi.)
TEMPERATURE AT INLET	TFAN1	0.51867E+03	(R)
STATION NUMBER AT EXIT	STIDEX	3	
PRESSURE AT EXIT	PFAN2	0.52047E+02	(psi.)
TEMPERATURE AT EXIT	TFAN2	0.79317E+03	(R)
COMPONENT TYPE: HPC	NCC	5	
STATION NUMBER AT INLET	STIDIN	5	
PRESSURE AT INLET	PHPC1	0.51527E+02	(psi.)
TEMPERATURE AT INLET	THPC1	0.79317E+03	(R)
STATION NUMBER AT EXIT	STIDEX	6	
PRESSURE AT EXIT	PHPC2	0.30870E+03	(psi.)
TEMPERATURE AT EXIT	THPC2	0.13524E+04	(R)
STATION NUMBER AT EXIT	STIDEX	17	
PRESSURE AT EXIT	PHPC2	0.23706E+03	(psi.)
TEMPERATURE AT EXIT	THPC2	0.12545E+04	(R)
COMPONENT TYPE: PBUR	NCC	7	
STATION NUMBER AT INLET	STIDIN	7	
PRESSURE AT INLET	PPBUR1	0.30870E+03	(psi.)
TEMPERATURE AT INLET	TPBUR1	0.13524E+04	(R)
STATION NUMBER AT EXIT	STIDEX	8	
PRESSURE AT EXIT	PPBUR2	0.29018E+03	(psi.)
TEMPERATURE AT EXIT	TPBUR2	0.30869E+04	(R)
COMPONENT TYPE: HPT	NCC	8	
STATION NUMBER AT INLET	STIDIN	8	
PRESSURE AT INLET	PHPT1	0.29018E+03	(psi.)
TEMPERATURE AT INLET	THPT1	0.30869E+04	(R)
STATION NUMBER AT EXIT	STIDEX	9	
PRESSURE AT EXIT	PHPT2	0.11193E+03	(psi.)
TEMPERATURE AT EXIT	THPT2	0.23650E+04	(R)
STATION NUMBER AT INLET	STIDIN	17	
PRESSURE AT INLET	PHPT1	0.23706E+03	(psi.)
TEMPERATURE AT INLET	THPT1	0.12545E+04	(R)
COMPONENT TYPE: LPT	NCC	9	
STATION NUMBER AT INLET	STIDIN	9	
PRESSURE AT INLET	PLPT1	0.11193E+03	(psi.)
TEMPERATURE AT INLET	TLPT1	0.23650E+04	(R)
STATION NUMBER AT EXIT	STIDEX	10	
PRESSURE AT EXIT	PLPT2	0.50257E+02	(psi.)
TEMPERATURE AT EXIT	TLPT2	0.19360E+04	(R)
STATION NUMBER AT INLET	STIDIN	17	
PRESSURE AT INLET	PLPT1	0.23706E+03	(psi.)
TEMPERATURE AT INLET	TLPT1	0.12545E+04	(R)
COMPONENT TYPE: AUG	NCC	12	
STATION NUMBER AT INLET	STIDIN	12	
PRESSURE AT INLET	PAUG1	0.49699E+02	(psi.)
TEMPERATURE AT INLET	TAUG1	0.15536E+04	(R)
STATION NUMBER AT EXIT	STIDEX	13	
PRESSURE AT EXIT	PAUG2	0.48705E+02	(psi.)
TEMPERATURE AT EXIT	TAUG2	0.15481E+04	(R)
STATION NUMBER AT INLET	STIDIN	17	
PRESSURE AT INLET	PAUG1	0.23706E+03	(psi.)
TEMPERATURE AT INLET	TAUG1	0.12545E+04	(R)
CRUISE ALTITUDE	ALT	0.60000E+05	(ft.)
CRUISE SPEED	VC	0.24000E+01	(MACH NO.)
CRUISE SPECIFIC FUEL CONSUP	SFCC	0.12050E+01	(LB/LBT/HR)
CRUISE THRUST	ATC	0.16285E+05	(LBST)
RANGE	RANGE	0.50000E+04	(MILES)
BREGUET RANGE	BRANGE	0.70997E+04	(MILES)
TIME TO CLIMB	TC	0.50000E+00	(HOURS)
TIME TO DECEND	TD	0.50000E+00	(HOURS)

DAY NITE FACTOR	DNF	0.12500E+01	
SPARE PARTS FACTOR	SPF	0.15000E+01	
CAPTAIN'S PAY	ODPP	0.50000E+00	($/HOUR)
COPILOT'S PAY	ODPCP	0.25000E+00	($/HOUR)
FLIGHT'S ENGINEER PAY	ODPFE	0.25000E+00	($/HOUR)
GROSS NAT. PROD. DEF. RAT.	GNPDR	4.08122E+00	
DOMESTIC TRAVEL FACTOR	ED	0.18000E+01	($/HOUR)
INTERNATIONAL TAVEL FACTOR	EI	0.28000E+01	($/HOUR)
TRAINING FACTOR	KT	0.40000E-01	
VACATION FACTOR	KV	0.50000E-01	
CREW PREMIUM FACTOR	KP	0.50000E-01	
PAYROLL TAX FACTOR	KI	0.12000E+00	
ANNUAL FLIGHT HOURS (U.S.A)	AHD	0.80000E+03	(HOURS)
ANNUAL FLIGHT HOURS (INT.)	AHI	0.75000E+03	(HOURS)
CAPTAIN'S BASE PAY	BPP	0.36000E+04	($/YEAR)
1ST OFFICER'S BASE PAY	BPCP	0.32000E+04	($/YEAR)
FLIGHT ENGINEER'S BASE PAY	BPFE	0.34000E+04	($/YEAR)
FUEL COST (USA)	AFUELD	0.11000E+00	($/GAL)
FUEL COST (INTERNATIONAL)	AFUELI	0.14000E+00	($/GAL)
JET OIL COST (US)	BOILTD	0.60000E+01	($/GAL)
JET OIL COST (INT.)	BOILTI	0.60000E+01	($/GAL)
ENGINE OIL (US)	BOILRD	0.41000E+00	($/GAL)
ENGINE OIL (INT.)	BOILRI	0.62000E+00	($/GAL)
FUEL CONSUMED AT CRUISE	FCR	0.10559E+06	(LBS)
FUEL USED IN CLIMB	FCL	0.15659E+05	(LBS)
FUEL USED IN DESCENT	FD	0.15659E+05	(LBS)
FUEL FOR GROUND MANEUVERS	FGM	0.15659E+05	(LBS)
DISTANCE FOR CLIMB	DC	0.57799E+03	(MILES)
DISTANCE DESCENT	DD	0.57799E+03	(MILES)
MANEUVERING DISTANCE	DAM	0.28899E+02	(MILES)
GROUND SPEED	VG	0.26784E+04	(MPH)
COST OF COMPLETE AIRPLANE	CT	0.12916E+08	($)
COST OF AIRPLANE LESS ENG.	CSPA	0.10819E+08	($)
COST OF AIR. LESS ENG,PROP	CA	0.10819E+08	($)
COST OF ONE ENGINE	CE	0.52426E+06	($)
COST OF ONE PROP	CP	0.52426E+05	($)
NUMBER OF PROPS	ANP	0.00000E+00	
TIME BETWEEN ENG. OVERHAULS	HEO	0.11000E+04	(HOURS)
TAKEOFF EQUIV. HORSE POWER	ESHP	0.00000E+00	(LBS)
DENSITY OF FUEL	WF	0.65000E+01	(LBS/GAL)
DENSITY OF OIL	WO	0.81000E+01	(LBS/GAL)
INSURANCE RATE DOLLAR/VALUE	AIRA	0.40000E-01	(%/YR,eg .04)
INSURANCE: LIABILITY&DAMAGE	PLPD	0.87000E-03	($/MILE)
LABOR COST	RL	0.30000E+01	($/HOUR)
AIRPLANE DEPRECIAT. FACTOR	AKDA	0.85000E+00	
ENGINE DEPRECIATION FACTOR	AKDE	0.85000E+00	
PROP DEPRECIATION FACTOR	AKDP	0.85000E+00	
SPARE AIRPLANE DEPRECIATION	AKDSA	0.85000E+00	
SPARE ENGINE DEPRECIATION	AKDSE	0.85000E+00	
AIRFRAME DEPRECIATION	DA	0.10000E+02	(YEARS)
ENGINE DEPRECIATION	DE	0.70000E+01	(YEARS)
PROP DEPRECIATION	DP	0.70000E+01	(YEARS)
SPARE AIRFRAME DEPRECIATION	DAS	0.10000E+02	(YEARS)
SPARE ENGINE DEPRECIATION	DES	0.10000E+02	(YEARS)
AIRPLANE SPARES/AIR. PRICE	AKSPA	0.10000E+00	
ENGINE SPARES/ENGINE PRICE	AKSPE	0.50000E+00	
BLOCK FUEL	FB	0.15659E+06	(LBS)
CAPTAIN GROSS WEIGHT FACTOR	GWFP	0.59748E+01	($/HR)
1ST OF. GROSS WEIGHT FACTOR	GWFCP	0.29029E+01	($/HR)
FLT. ENG. GROSS WT. FACTOR	GWFFE	0.30832E+01	($/HR)
CAPTAIN MILEAGE RATE FACTOR	XMRFP	0.29495E+02	($/HR)
1ST OF. MILEAGE RATE FACTOR	XMRCP	0.15492E+02	($/HR)

Listing of "*neutral.file*" (Continued)

FLT ENG MILEAGE RATE FACTOR	XMRFE	0.14196E+02	($/HR)
TIME TO CRUISE DOMESTIC	TGD	0.15580E+01	(HOURS)
GROUND MANUEVERING TIME	TGM	0.42945E+00	(HOURS)
DOMESTIC BLOCK TIME	TBD	0.29874E+01	(HOURS)
DOMESTIC BLOCK SPEED	VBD	0.16737E+04	(MPH)
DOM. TURBINE AIRCRAFT UTIL.	UTD	0.32328E+04	(HRS/YEAR)
DOM. RECP. ENG. AIR. UTIL.	URD	0.35370E+04	(HRS/YEAR)
INTERNATIONAL BLOCK SPEED	VBI	0.17277E+04	(MPH)
INTERNATIONAL BLOCK TIME	TBI	0.28941E+01	(HOURS)
TIME TO CRUISE INTERNAT.	TGI	0.14646E+01	(HOURS)
INT TURBINE AIR. UTILIZAION	UTI	0.32233E+04	(HRS/YEAR)
INT RECP. ENG. AIR. UTIL.	URI	0.35227E+04	(HRS/YEAR)
CAPTAINS DOMESTIC COST	CAMPD	0.43656E-01	($/MILE)
1S OFFICERS DOMESTIC COST	CAMCPD	0.30236E-01	($/MILE)
FLIGHT ENG. DOMESTIC COST	CAMFED	0.41102E-01	($/MILE)
DOMESTIC FUEL COST	CFTD	0.54590E+00	($/MILE)
DOMESTIC OIL COST	COTD	0.12217E-02	($/MILE)
DOMESTIC INSURANCE COSTS	CINTD	0.96357E-01	($/MILE)
DOM TURB AIRFR LABOR COST	ALBTD	0.36255E-01	($/MILE)
DOM TURB AIRFR BURDEN COST	ALBTDMB	0.32267E-01	($/MILE)
DOM REC ENG AIR LABOR COST	ALBRD	0.33855E-01	($/MILE)
DOM REC ENG BURDEN COST	ALBRDMB	0.30131E-01	($/MILE)
DOM TURB ENG LABOR MAINT.	ELBTD	0.96526E-02	($/MILE)
DOM TURB ENG BURDEN COST	ELBTDMB	0.85908E-02	($/MILE)
DOM TURBPROP ENG LABOR MAIN	ELBPD	0.73117E-02	($/MILE)
DOM TURBPROP ENG BURDEN	ELBPDMB	0.65074E-02	($/MILE)
DOM REC ENG. LABOR MAINT.	ELBRD	0.98969E-01	($/MILE)
DOM REC ENG MAINT BURDEN	ELBRDMB	0.88082E-01	($/MILE)
DOM TURB ENG AIR MAINT MATE	CMATD	0.54138E-01	($/MILE)
DOM TURB ENG AIR MAINT BURD	CMATDMB	0.12614E-01	($/MILE)
DOM REC ENG AIR MAINT MATE	CMARD	0.33472E-01	($/MILE)
DOM REC ENG AIR MAINT BURD	CMARDMB	0.77991E-02	($/MILE)
DOM TURB ENG MAINT MATERIAL	CMETD	0.10396E+00	($/MILE)
DOM TURB ENG MAINT BURDEN	CMETDMB	0.24222E-01	($/MILE)
DOM REC ENG MAINT MATERIALS	CMERD	0.39581E+00	($/MILE)
DOM REC ENG MAINT BURDEN	CMERDMB	0.92223E-01	($/MILE)
DOM TURB AIR APP MAINT BURD	CMBTD	0.77694E-01	($/MILE)
DOM REC ENG AIR APP BURDEN	CMBRD	0.21824E+00	($/MILE)
DOM TURBPROP AIR. APP. BURD	CMBPD	0.75611E-01	($/MILE)
DOM TURB AIR DEPRECIATION	CDATD	0.16997E+00	($/MILE)
DOM REC ENG AIRCRAFT DEPREC	CDARD	0.15535E+00	($/MILE)
DOM TURB ENG DEPRECIATION	CDETD	0.47063E-01	($/MILE)
DOM. REC. ENG DEPRECIATION	CDERD	0.43016E-01	($/MILE)
DOM SPARE TURB AIR. DEPRECI	DSATD	0.16997E-01	($/MILE)
DOM SPARE REC ENG AIR DEPRE	DSARD	0.15535E-01	($/MILE)
DOM. SPARE TURB ENG DEPRECI	DSETD	0.35298E-01	($/MILE)
DOM. SPARE REC. ENG DEPRECI	DSERD	0.32262E-01	($/MILE)
DOM. SPARE PROP DEPRECIATIO	CDPD	0.00000E+00	($/MILE)
INTERNATIONAL FUEL COSTS	CFTI	0.69478E+00	($/MILE)
INTERNATIONAL OIL COSTS	COTI	0.11835E-02	($/MILE)
INTERNATIONAL INSURANCE	CINTI	0.93646E-01	($/MILE)
INT. TURB AIRFRAME LABOR	ALBTI	0.35123E-01	($/MILE)
INT. REC. ENG. AIR LABOR	ALBRI	0.32797E-01	($/MILE)
INT. TURB ENG LABOR MAINTE	ELBTI	0.93510E-02	($/MILE)
INT TURBPROP ENG. LABOR MAI	ELBPI	0.70832E-02	($/MILE)
INT REC ENG LABOR MAINTENAN	ELBRI	0.95877E-01	($/MILE)
INT TURB ENG AIR MAIN MATER	CMATI	0.52446E-01	($/MILE)
INT REC ENG AIR MAINT MATER	CMARI	0.32427E-01	($/MILE)
INT TURB ENG MAINT MATERIAL	CMETI	0.10071E+00	($/MILE)
INT REC ENG MAINT MATERIALS	CMERI	0.38344E+00	($/MILE)
INT TURB AIR APP MAINT BURD	CMBTD	0.77694E-01	($/MILE)
INT REC ENG AIR APP BURD	CMBRD	0.21824E+00	($/MILE)

INT. TURBOPROP AIR APP BURD	CMBPD	0.75611E-01	($/MILE)
INT. TURB AIR DEPRECIATION	CDATI	0.16514E+00	($/MILE)
INT REC ENG AIR DEPRECIATIO	CDARI	0.15111E+00	($/MILE)
INT TURB ENG DEPRECIATION	CDETI	0.45727E-01	($/MILE)
INT. REC. ENG DEPRECIATION	CDERI	0.41841E-01	($/MILE)
INT. SPARE TURB. AIR DEPREC	DSATI	0.16514E-01	($/MILE)
INT SPARE REC ENG AIR DEPR	DSARI	0.15111E-01	($/MILE)
INT. SPARE TURB ENG DEPRECI	DSETI	0.34295E-01	($/MILE)
INT. SPARE REC. ENG DEPRECI	DSERI	0.31381E-01	($/MILE)
INT. SPARE PROP DEPRECIATIO	CDPI	0.00000E+00	($/MILE)
U. S. CITY PAIRS	USCITY	0.21550E+04	
WESTERN EUROPE CITY PAIRS	INTCITY	0.44910E+04	
NEW JET/FAN MAIN. COST 1YR	NEWT1	0.32946E+00	($/MILE)
DERIVATIVE JET/FAN ENG 1YR	DERT1	0.36606E-01	($/MILE)
NEW JET/FAN MAIN. COST 2YR	NEWT2	0.47588E+00	($/MILE)
DERIVATIVE JET/FAN ENG 2YR	DERT2	0.73213E-01	($/MILE)
NEW JET/FAN MAIN. COST 3YR	NEWT3	0.40267E+00	($/MILE)
DERIVATIVE JET/FAN ENG 3YR	DERT3	0.10982E+00	($/MILE)
NEW JET/FAN MAIN. COST 4YR	NEWT4	0.32946E+00	($/MILE)
DERIVATIVE JET/FAN ENG 4YR	DERT4	0.12812E+00	($/MILE)
NEW JET/FAN MAIN. COST 5YR	NEWT5	0.25624E+00	($/MILE)
DERIVATIVE JET/FAN ENG 5YR	DERT5	0.13727E+00	($/MILE)
NEW JET/FAN MAIN. COST 6YR	NEWT6	0.21964E+00	($/MILE)
DERIVATIVE JET/FAN ENG 6YR	DERT6	0.14643E+00	($/MILE)
NEW JET/FAN MAIN. COST 7YR	NEWT7	0.18303E+00	($/MILE)
DERIVATIVE JET/FAN ENG 7YR	DERT7	0.15009E+00	($/MILE)
NEW JET/FAN MAIN. COST 8YR	NEWT8	0.16473E+00	($/MILE)
DERIVATIVE JET/FAN ENG 8YR	DERT8	0.15009E+00	($/MILE)
NEW JET/FAN MAIN. COST 9YR	NEWT9	0.14643E+00	($/MILE)
DERIVATIVE JET/FAN ENG 9YR	DERT9	0.14643E+00	($/MILE)
NEW JET/FAN MAIN. COST 10YR	NEWT10	0.14276E+00	($/MILE)
DERIVATIVE JET/FAN ENG 10YR	DERT10	0.14276E+00	($/MILE)
NEW JET/FAN MAIN. COST 11YR	NEWT11	0.13910E+00	($/MILE)
DERIVATIVE JET/FAN ENG 11YR	DERT11	0.13910E+00	($/MILE)
NEW JET/FAN MAIN. COST 12YR	NEWT12	0.13727E+00	($/MILE)
DERIVATIVE JET/FAN ENG 12YR	DERT12	0.13727E+00	($/MILE)
NEW JET/FAN 8YR TOTAL	NEWTJET	0.36922E+07	($)
DERIVATIVE JET/FAN 8YR TOTA	DERTJET	0.14568E+07	($)
NEW TURPROP MAIN. COST 1YR	NEWP1	0.31950E+00	($/MILE)
DERIVATIVE JET/FAN ENG 1YR	DERP1	0.35500E-01	($/MILE)
NEW TURPROP MAIN. COST 2YR	NEWP2	0.46150E+00	($/MILE)
DERIVATIVE JET/FAN ENG 2YR	DERP2	0.71001E-01	($/MILE)
NEW TURPROP MAIN. COST 3YR	NEWP3	0.39050E+00	($/MILE)
DERIVATIVE JET/FAN ENG 3YR	DERP3	0.10650E+00	($/MILE)
NEW TURPROP MAIN. COST 4YR	NEWP4	0.31950E+00	($/MILE)
DERIVATIVE JET/FAN ENG 4YR	DERP4	0.12425E+00	($/MILE)
NEW TURPROP MAIN. COST 5YR	NEWP5	0.24850E+00	($/MILE)
DERIVATIVE JET/FAN ENG 5YR	DERP5	0.13313E+00	($/MILE)
NEW TURPROP MAIN. COST 6YR	NEWP6	0.21300E+00	($/MILE)
DERIVATIVE JET/FAN ENG 6YR	DERP6	0.14200E+00	($/MILE)
NEW TURPROP MAIN. COST 7YR	NEWP7	0.17750E+00	($/MILE)
DERIVATIVE JET/FAN ENG 7YR	DERP7	0.14555E+00	($/MILE)
NEW TURPROP MAIN. COST 8YR	NEWP8	0.15975E+00	($/MILE)
DERIVATIVE JET/FAN ENG 8YR	DERP8	0.14555E+00	($/MILE)
NEW TURPROP MAIN. COST 9YR	NEWP9	0.14200E+00	($/MILE)
DERIVATIVE JET/FAN ENG 9YR	DERP9	0.14200E+00	($/MILE)
NEW TURPROP MAIN. COST 10YR	NEWP10	0.13845E+00	($/MILE)
DERIVATIVE JET/FAN ENG 10YR	DERP10	0.13845E+00	($/MILE)
NEW TURPROP MAIN. COST 11YR	NEWP11	0.13490E+00	($/MILE)
DERIVATIVE JET/FAN ENG 11YR	DERP11	0.13490E+00	($/MILE)
NEW TURPROP MAIN. COST 12YR	NEWP12	0.13313E+00	($/MILE)

DERIVATIVE JET/FAN ENG 12YR	DERP12	0.13313E+00	($/MILE)	
NEW RECIENG 8YR TOTAL	NEWPJET	0.35806E+07	($)	
DERIVATIVE RECIENG 8YR TOTA	DERPJET	0.14128E+07	($)	
NEW RECIENG MAIN. COST 1YR	NEWR1	0.15189E+01	($/MILE)	
DERIVATIVE RECIENG ENG 1YR	DERR1	0.16877E+00	($/MILE)	
NEW RECIENG MAIN. COST 2YR	NEWR2	0.21940E+01	($/MILE)	
DERIVATIVE RECIENG ENG 2YR	DERR2	0.33754E+00	($/MILE)	
NEW RECIENG MAIN. COST 3YR	NEWR3	0.18565E+01	($/MILE)	
DERIVATIVE RECIENG ENG 3YR	DERR3	0.50631E+00	($/MILE)	
NEW RECIENG MAIN. COST 4YR	NEWR4	0.15189E+01	($/MILE)	
DERIVATIVE RECIENG ENG 4YR	DERR4	0.59070E+00	($/MILE)	
NEW RECIENG MAIN. COST 5YR	NEWR5	0.11814E+01	($/MILE)	
DERIVATIVE RECIENG ENG 5YR	DERR5	0.63289E+00	($/MILE)	
NEW RECIENG MAIN. COST 6YR	NEWR6	0.10126E+01	($/MILE)	
DERIVATIVE RECIENG ENG 6YR	DERR6	0.67508E+00	($/MILE)	
NEW RECIENG MAIN. COST 7YR	NEWR7	0.84386E+00	($/MILE)	
DERIVATIVE RECIENG ENG 7YR	DERR7	0.69196E+00	($/MILE)	
NEW RECIENG MAIN. COST 8YR	NEWR8	0.75947E+00	($/MILE)	
DERIVATIVE RECIENG ENG 8YR	DERR8	0.69196E+00	($/MILE)	
NEW RECIENG MAIN. COST 9YR	NEWR9	0.67508E+00	($/MILE)	
DERIVATIVE RECIENG ENG 9YR	DERR9	0.67508E+00	($/MILE)	
NEW RECIENG MAIN. COST 10YR	NEWR10	0.65821E+00	($/MILE)	
DERIVATIVE RECIENG ENG 10YR	DERR10	0.65821E+00	($/MILE)	
NEW RECIENG MAIN. COST 11YR	NEWR11	0.64133E+00	($/MILE)	
DERIVATIVE RECIENG ENG 11YR	DERR11	0.64133E+00	($/MILE)	
NEW RECIENG MAIN. COST 12YR	NEWR12	0.63289E+00	($/MILE)	
DERIVATIVE RECIENG ENG 12YR	DERR12	0.63289E+00	($/MILE)	
NEW RECIENG 8YR TOTAL	NEWRENG	0.17023E+08	($)	
DERIVATIVE RECIENG 8YR TOTA	DERRENG	0.67167E+07	($)	
LOW PRESSURE COMPRESS PRICE	LCPRICE	0.00000E+00	($)	
HIGH PRESSURE COMPRES PRICE	HCPRICE	0.00000E+00	($)	
INLET PRICE	INPRICE	0.00000E+00	($)	(NOT ACTUAL)
DUCT PRICE	DUPRICE	0.00000E+00	($)	(NOT ACTUAL)
BURNER PRICE	BUPRICE	0.00000E+00	($)	(NOT ACTUAL)
AUGMENTER PRICE	AUPRICE	0.00000E+00	($)	(NOT ACTUAL)
MIXER PRICE	FMPRICE	0.00000E+00	($)	(NOT ACTUAL)
NOZZLE PRICE	NOPRICE	0.00000E+00	($)	(NOT ACTUAL)
SHAFT PRICE	SHPRICE	0.00000E+00	($)	(NOT ACTUAL)
DIFFUSER PRICE	DIFPRICE	0.00000E+00	($)	
COMBUSTOR PRICE	CBPRICE	0.00000E+00	($)	
HIGH PRESSURE TURBINE PRICE	HTPRICE	0.00000E+00	($)	
LOW PRESSURE TURBINE PRICE	LTPRICE	0.00000E+00	($)	
LOW PRESSURE COMPRESS MTBR	LCMTBR	0.19691E+05	(HR)	
HIGH PRESSURE COMPRES MTBR	HCMTBR	0.15765E+05	(HR)	
INLET MEAN TIME REPAIR	INMTBR	0.19691E+05	(HR)	
DUCT MEAN TIME REPAIR	DUMTBR	0.19691E+05	(HR)	
BURNER MEAN TIME REPAIR	BUMTBR	0.61905E+04	(HR)	
AUGMENTER MEAN TIME REPAIR	AUMTBR	0.61905E+04	(HR)	
MIXER MEAN TIME REPAIR	FMMTBR	0.19691E+05	(HR)	
NOZZLE MEAN TIME REPAIR	NOMTBR	0.19691E+05	(HR)	
SHAFT MEAN TIME REPAIR	SHMTBR	0.19691E+05	(HR)	
DIFFUSER MTBR	DIFMTBR	0.50000E+04	(HR)	
COMBUSTOR MTBR	CBMTBR	0.61905E+04	(HR)	
HIGH PRESSURE TURBINE MTBR	HTMTBR	0.56500E+04	(HR)	
LOW PRESSURE TURBINE MTBR	LTMTBR	0.53961E+04	(HR)	
LOW PRESSURE COMPRESS LABOR	LCHOURS	0.40915E+02	(HR)	
HIGH PRESSURE COMPRES LABOR	HCHOURS	0.44059E+02	(HR)	
INLET LABOR	INHOURS	0.40915E+02	(HR)	
DUCT LABOR	DUHOURS	0.40915E+02	(HR)	
BURNER LABOR	BUHOURS	0.25000E+03	(HR)	
AUGMENTER LABOR	AUHOURS	0.25000E+03	(HR)	
MIXER LABOR	FMHOURS	0.40915E+02	(HR)	

Listing of "*neutral.file*" (Continued)

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  NOZZLE LABOR                  NOHOURS     0.40915E+02    (HR)
  SHAFT LABOR                   SHHOURS     0.40915E+02    (HR)
  DIFFUSER LABOR                DIFHOURS    0.17500E+03    (HR)
  COMBUSTOR LABOR               CBHOURS     0.25000E+03    (HR)
  HIGH PRESSURE TURBINE LABOR   HTHOURS     0.98904E+02    (HR)
  LOW  PRESSURE TURBINE LABOR   LTHOURS     0.27310E+03    (HR)
  LPC MATERIALS COST            LCCOST      0.45123E-01    ($)
  HPC MATERIALS COST            HCCOST      0.41152E-01    ($)
  INLET MATERIALS COST          INCOST      0.45123E-01    ($)      (NOT ACTUAL)
  DUCT MATERIALS COST           DUCOST      0.45123E-01    ($)      (NOT ACTUAL)
  BURNER MATERIALS COST         BUCOST      0.44762E-01    ($)      (NOT ACTUAL)
  AUGMENTER MATERIALS COST      AUCOST      0.44762E-01    ($)      (NOT ACTUAL)
  MIXER MATERIALS COST          FMCOST      0.45123E-01    ($)      (NOT ACTUAL)
  NOZZLE MATERIALS COST         NOCOST      0.45123E-01    ($)      (NOT ACTUAL)
  SHAFT MATERIALS COST          SHCOST      0.45123E-01    ($)      (NOT ACTUAL)
  DIFFUSER MATERIALS COST       DIFCOST     0.59202E-01    ($)
  COMBUSTOR MATERIALS COS       CBCOST      0.44762E-01    ($)
  HPT MATERIALS COST            HTCOST      0.85915E-01    ($)
  LPT MATERIALS COST            LTCOST      0.32128E-01    ($)
BEGIN FLOPS DATA
FLOPS PROGRAM CONTROL
  FLOPS PROBLEM TYPE            IOPT          1
  FLOPS ANALYSIS OPTION         IANAL         3
  FLOPS COST ANALYSIS FLAG      ICOST         1
FLOPS GEOMETRIC, WEIGHT, BALANCE AND INERTIA DATA
  STRUCTURAL ULTIMATE LOAD      ULF         0.42200E+01    (FACTOR)
FLOPS WING DATA
  DIHEDRAL (POSITIVE)           DIH         0.70000E+00    (deg.)
FLOPS HORIZONTAL TAIL DATA
  AREA                          SHT         0.38881E+03    (ft^2)
  1/4 CHORD SWEEP ANGLE         SWPHT       0.35000E+02    (deg.)
  ASPECT RATIO                  ARHT        0.40000E+01
  TAPER RATIO                   TRHT        0.40000E+00
  T/C                           TCHT        0.11000E+00
  LOCATION ON VERTICAL TAIL     HHT         0.10000E+01
FLOPS VERTICAL TAIL DATA
  NUMBER OF VERTICAL TAILS      NVERT         1
  AREA                          SVT         0.39387E+03    (ft^2)
  1/4 CHORD SWEEP ANGLE         SWPVT       0.55000E+02    (deg.)
  ASPECT RATIO                  ARVT        0.67000E+00
  TAPER RATIO                   TRVT        0.70000E+00
  T/C                           TCVT        0.12000E+00
FLOPS FUSELAGE DATA
  NUMBER OF FUSELAGES           NFUSE         1
  TOTAL LENGTH                  XL          0.15235E+03    (ft)
  MAXIMUM WIDTH                 WF          0.16440E+02    (ft)
  MAXIMUM DEPTH                 DF          0.17000E+02    (ft)
  CARGO AIRCRAFT FACTOR         CARGF       0.00000E+00
  PASSENGER COMPART LENGTH      XLP         0.00000E+00    (ft)
FLOPS LANDING GEAR DATA
  LENGTH OF MAIN GEAR           XMLG        0.00000E+00    (in)
  LENGTH OF NOSE GEAR           XNLG        0.00000E+00    (in)
  CARRIER BASED AIRCRAFT        CARBAS      0.00000E+00
FLOPS PROPULSION SYSTEM DATA
  NUMBER OF ENGINES ON WING     NEW           4
  NUMBER OF ENGINES ON FUSE     NEF           0
  BASELINE ENGINE THRUST        THRSO       0.40595E+05    (lbf)
  BASELINE ENGINE WEIGHT        WENG        0.11705E+05    (lbf)
  WEIGHT SCALING PARAMETER      EEXP        0.11500E+01
  BASELINE NACELLE LENGTH       XNAC        0.30083E+02    (ft)
  BASELINE NACELLE DIAMETER     DNAC        0.58667E+01    (ft)
  FUEL CAPACITY OF WING         FULWMX     -0.10000E+01    (lbm)
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   FUEL CAPACITY OF FUSELAGE   FULFMX     0.00000E+00   (lbm)
   AUX. TANK FUEL CAPACITY     FULAUX     0.00000E+00   (lbm)
   NUMBER OF FUEL TANKS        NTANK       10
   ADDED MISC PROP SYSTEM WT   WPMISC     0.00000E+00   (lbf)
 FLOPS CREW AND PAYLOAD DATA   .
   FIRST CLASS PASSENGERS      NPF         20
   TOURIST PASSENGERS          NPT        180
   STEWARDESSES                NSTU         5
   GALLEY CREW                 NGALC        0
   FLIGHT CREW                 NFLCR        3
   WEIGHT PER PASSENGER        WPPASS     0.16500E+03   (lbf)
   BAGGAGE PER PASSENGER       BPP        0.40000E+02   (lbf)
 FLOPS OVERRIDE PARAMETERS FOR WEIGHTS (ALL SET TO TO 1.0 EXCEPT WTHR)
   THRUST REVERSERS - TOTAL    WTHR       0.36100E+04
 FLOPS CONFINGURATION GEOMETRIC RATIOS, OBJ. FUNCTION, DESIGN VARIABLES
   DESIGN RANGE                DESRNG     0.50000E+04   (n.mi)
   WING LOADING REQUIRED       WSR        0.11000E+03
   THRUST/WEIGHT REQUIRED      TWR        0.50000E+00
   HORIZ TAIL VOLUME COEF      HTVC       0.10000E+01
   VERT TAIL VOLUME COEF       VTVC       0.10000E+01
   RAMP WEIGHT                 GWFLOPS    0.59696E+06   (lbf)
   WING ASPECT RATIO           ARFLOPS    0.50000E+01
   WING TAPER RATIO            TRFLOPS    0.08000E+00
   WING 1/4 CHORD SWEEP        SWEEP      0.31500E+02   (deg.)
   WING THICKNESS-CHORD RATIO  TCA        0.06000E+00
   CRUISE MACH NUMBER          VCMN       0.24000E+01
   MAX CRUISE ALTITUDE         CH         0.60000E+05   (ft)
   OBJ. FUN. WEIGHTING FACTOR  OFG        0.00000E+00   (GROSS WEIGHT)
   OBJ. FUN. WEIGHTING FACTOR  OFF        0.00000E+00   (MISSION FUEL)
   OBJ. FUN. WEIGHTING FACTOR  OFC        0.00000E+00   (COST)
 FLOPS AERODYNAMIC OPTIONS AND APPROXIMATE TAKEOFF AND LANDING DATA
   WING TECHNOLOGY             AITEK      0.15000E+01
   FIXED DESIGN LIFT COEFFIC.  FCLDES    -0.10000E+01
   TURBULENT/LAMINAR FLOW      XLLAM      0.00000E+00   (1.0 FOR LAMINAR)
 FLOPS TAKEOFF AND LANDING DATA
   MAX. LANDING/TAKEOFF WEIGHT WRATIO     0.81250E+00
   MAX. LANDING VELOCITY       VAPPR      0.15000E+03   (kts)
   MAX. TAKEOFF FIELD LENGTH   FLTO       0.70000E+04   (ft)
   MAX. LANDING FIELD LENGTH   FLLDG      0.70000E+04   (ft)
   MAX. CL TAKEOFF CONFIG.     CLTOM      0.20000E+01
   MAX. CL LANDING CONFIG.     CLLDM      0.30000E+01
   AIR DENSITY RATIO           DRATIO     0.10000E+01
 FLOPS ENGINE DECK CONTROL, SCALING AND USAGE DATA
   FLIGHT IDLE SWITCH          IDLE         1
   INDICATOR OF ENGINE DECK    IGENEN      -1           (-1 FOR EXTERNAL)
   MIN IDLE FUEL FLOW FRACT    FIDMIN     0.80000E-01
   MAX IDLE FUEL FLOW FRACT    FIDMAX     0.10000E+01
   ENGINE DECK FILE NAME       EIFILE    nnepwate.missout
 FLOPS PERFORMANCE CONTROLS AND FACTORS AND MISSION SEGMENT DEFINITION
   PRINT MISSION CONTROL       IFLAG        1
   DETAILED MISSION PRINT      MSUMPT       1
   FLAG FOR RAMP WEIGHT ESTIM. IRW          1
   FUEL FLOW FACTOR            FACT       0.90000E+00
   CDO FACTOR                  FCDO       0.10000E+01
   CDI FACTOR                  FCDI       0.10000E+01
   OWE FACTOR                  OWFACT     0.10000E+01
   RANGE TOLERANCE             RTOL       0.10000E+00   (n.mi)
   ATA TRAFFIC ALLOWANCE       IATA         1
   WEIGHT INCREMENT            DWT        0.10000E+01   (lbf)
 FLOPS GROUND OPERATIONS AND TAKEOFF INPUT
   TAKEOFF TIME                TAKOTM     0.40000E+00   (min)
   TAXI-OUT TIME               TAXOTM     0.10000E+02   (min)
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Listing of "*neutral.file*" (Continued)

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     TAXI-IN TIME                  TAXITM      0.10000E+02    (min)
     TAKEOFF POWER SETTING         ITTFF         1
   FLOPS INPUT FOR 1 CLIMB SCHEDULES
     MINIMUM CLIMB MACH NUMBER     CLMMIN      0.30000E+00
     MINIMUM CLIMB ALTITUDE        CLAMIN      0.00000E+00    (ft)
     NUMBER OF CLIMB STEPS         NINCL        15
     CLIMB OPTIMIZATION FACTOR     FWF        -0.10000E+01
   FLOPS INPUT FOR 1 CRUISE SCHEDULES
     CRUISE OPTION SWITCH          IOC           1
     MINIMUM MACH NUMBER           CRMMIN      0.70000E+00
   FLOPS INPUT FOR DESCENT SCHEDULE
     MINIMUM DESCENT ALTITUDE      DEAMIN      0.00000E+00    (ft)
   FLOPS RESERVE SEGMENT INPUT
     MISSED APPROACH TIME          TIMMAP      0.50000E+01    (min)
     RESERVE HOLDING TIME          HOLDTM      0.30000E+02    (min)
     2ND RES HOLD TIME OR FRAC     THOLD       0.50000E-01    (min)
   FLOPS INPUT FOR DESCENT SCHEDULE
     NUMBER OF DESCENT STEPS       NINDE        15
     MINIMUM DESCENT MACH NO.      DEMMIN      0.30000E+00
   FLOPS COST CALCULATION DATA
     TYPE OF COST CALCULATION      ICOSTP        5
     R&D SWITCH                    IRAD          1
     YEAR FOR CALCULATIONS         DYEAR       0.19870E+04    (year)
     DEVELOPMENT START TIME        DEVST       0.19700E+04    (year)
     FAA CERTIFICATION DATE        PLMQT       0.19800E+04    (year)
     SPARES FACTOR FOR AIRFRAME    FAFMSP      0.10000E+00
     SPARES FACTOR FOR ENGINES     FENGSP      0.30000E+00
     AIRFRAME PRODUCTION QUANT.    Q           0.40000E+03
     NO OF PROTOTYPE AIRCRAFT      NPROTP        2
     NO OF FLIGHT TEST AIRCRAFT    NFLTST        2
     SPARES FACTOR FOR DEVELOP.    FPPFT       0.50000E+00
     ENGINE PRESSURE RATIO         EPR         0.24200E+02
     FLOPS ENGINE DESIGN SFC       FLSFC       0.62000E+00    (lb/hr/lb)
     MAX TURBINE INLET TEMP        TEMPTUR     0.22820E+04    (deg. F)
     BODY TYPE SWITCH              IBODY         1
     CIRCUIT INDICATOR             ICIRC         2
     AC TOTAL PACK FLOW            AC          0.33000E+03    (lb/min)
     APU FLOW RATE                 APUFLW      0.38500E+03    (lb/min)
     APU SHAFT HORSEPOWER          APUSHP      0.17000E+03    (hp)
     HYDRAULIC PUMP FLOW RATE      HYDGPM      0.15000E+03    (gal/min)
     KVA RATING OF FULLTIME GENS   KVA         0.30000E+03    (kva)
     NO OF APUS                    NAPU          1
     NO OF AUTOPILOT CHANNELS      NCHAN         2
     NO OF INFLIGHTOPERATED GENS   NGEN          4
     MANUFACTURERS PROFIT RATE     PRORAT      0.15000E+02    (%
     DEPRECIATION PERIOD           DEPPER      0.14000E+02    (years)
     FARE                          FARE        0.09450E+00    ($/pass/mile)
     FUEL PRICE                    FUELPR      0.50000E+00    ($/gal)
     TAX RATE FOR ROI CALCUL.      TAXRAT      0.33000E+00
     NO OF PODDED ENGINES          NPOD          2
     DIRECT LABOR BURDEN FACTOR    DLBUR       0.20000E+01
     NO OF YEARS FOR LCC CALCUL.   LIFE        0.14000E+02    (years)
     RESIDUAL AT END OF DEPPER     RESID       0.15000E+02    (%)
     RETURN ON INVESTMENT          ROI         0.70000E+01    (%)
     LOAD FACTOR                   LF          0.55000E+02    (%)
     % OF SEATS FOR 1ST CLASS      PCTFC       0.10000E+02    (%)
     MULTIPLEX INDICATOR           IMUX          1            (YES=0, NO=1)
     AUXILIARY POWER INDICATOR     ISPOOL        1            (SINGLE=0, DOUBLE=1)
   FLOPS MISSION SUMMARY
     TAXI OUT INITIAL WEIGHT       WTAXOUT     0.13233E+07    (lb)
     TAXI OUT FUEL REQUIRED        FTAXOUT     0.59610E+04    (lb)
     TAKE OFF INITIAL WEIGHT       WTAXOFF     0.13174E+07    (lb)
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Listing of "*neutral.file*" (Continued)

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  TAXI OFF FUEL REQUIRED       FTAXOFF     0.29810E+04    (lb)
  CLIMB INITIAL WEIGHT         WTCLIMB     0.13144E+07    (lb)
  CLIMB FUEL REQUIRED          FLCLIMB     0.75417E+05    (lb)
  CRUISE INITIAL WEIGHT        WTCRUIS     0.12390E+07    (lb)
  CRUISE FUEL REQUIRED         FLCRUIS     0.61454E+06    (lb)
  DESCENT INITIAL WEIGHT       WTDESCE     0.62444E+06    (lb)
  DESCENT FUEL REQUIRED        FLDESCE     0.12255E+05    (lb)
  ZERO FUEL INITIAL WEIGHT     WTZEROF     0.58132E+06    (lb)
  TOTAL DESIGN RANGE           DERNMI      0.52603E+04    (n.mi)
  TOTAL FLIGHT TIME            TOTTIME     0.25850E+03    (min)
  TOTAL NITROGEN OXIDES EMISS TOTNITR      0.00000E+00    (lb)
FLOPS SEGMENT 1 CLIMB DETAILED FLIGHT DATA
  TIME SINCE TAKEOFF           TIME1       0.10400E+02    (min)
  CURRENT ALTITUDE             ALTIME1     0.00000E+00    (ft)
  CURRENT SPEED (MACH NUMBER) TIMACH1      0.30000E+00
  DISTANCE TRAVELED SOFAR      DIST1       0.00000E+00    (n.mi)
  CURRENT AIRCRAFT GROSS WGHT GWTIME1      0.13144E+07    (lb)
  AMOUNT OF FUEL CONSUMED      FUELTI1     0.89420E+04    (lb)
  CURRENT ENGINE THRUST        THRSTI1     0.56446E+06    (lbst)
  FLOPS SPECIFIC FUEL CONSUM. SFCFL1       0.91861E+00    (lb/lbt/hr)
  CURRENT FUEL FLOW RATE       FLOWFL1     0.51852E+06    (lb/hr)
  TIME SINCE TAKEOFF           TIME1       0.11150E+02    (min)
  CURRENT ALTITUDE             ALTIME1     0.33330E+04    (ft)
  CURRENT SPEED (MACH NUMBER) TIMACH1      0.40090E+00
  DISTANCE TRAVELED SOFAR      DIST1       0.28000E+01    (n.mi)
  CURRENT AIRCRAFT GROSS WGHT GWTIME1      0.13088E+07    (lb)
  AMOUNT OF FUEL CONSUMED      FUELTI1     0.14533E+05    (lb)
  CURRENT ENGINE THRUST        THRSTI1     0.50923E+06    (lbst)
  FLOPS SPECIFIC FUEL CONSUM. SFCFL1       0.94169E+00    (lb/lbt/hr)
  CURRENT FUEL FLOW RATE       FLOWFL1     0.47954E+06    (lb/hr)
  TIME SINCE TAKEOFF           TIME1       0.11620E+02    (min)
  CURRENT ALTITUDE             ALTIME1     0.66670E+04    (ft)
  CURRENT SPEED (MACH NUMBER) TIMACH1      0.42560E+00
  DISTANCE TRAVELED SOFAR      DIST1       0.49000E+01    (n.mi)
  CURRENT AIRCRAFT GROSS WGHT GWTIME1      0.13056E+07    (lb)
  AMOUNT OF FUEL CONSUMED      FUELTI1     0.17728E+05    (lb)
  CURRENT ENGINE THRUST        THRSTI1     0.45500E+06    (lbst)
  FLOPS SPECIFIC FUEL CONSUM. SFCFL1       0.92373E+00    (lb/lbt/hr)
  CURRENT FUEL FLOW RATE       FLOWFL1     0.42030E+06    (lb/hr)
  TIME SINCE TAKEOFF           TIME1       0.12150E+02    (min)
  CURRENT ALTITUDE             ALTIME1     0.10000E+05    (ft)
  CURRENT SPEED (MACH NUMBER) TIMACH1      0.45220E+00
  DISTANCE TRAVELED SOFAR      DIST1       0.73000E+01    (n.mi)
  CURRENT AIRCRAFT GROSS WGHT GWTIME1      0.13025E+07    (lb)
  AMOUNT OF FUEL CONSUMED      FUELTI1     0.20856E+05    (lb)
  CURRENT ENGINE THRUST        THRSTI1     0.39938E+06    (lbst)
  FLOPS SPECIFIC FUEL CONSUM. SFCFL1       0.90186E+00    (lb/lbt/hr)
  CURRENT FUEL FLOW RATE       FLOWFL1     0.36019E+06    (lb/hr)
  TIME SINCE TAKEOFF           TIME1       0.13020E+02    (min)
  CURRENT ALTITUDE             ALTIME1     0.11011E+05    (ft)
  CURRENT SPEED (MACH NUMBER) TIMACH1      0.86920E+00
  DISTANCE TRAVELED SOFAR      DIST1       0.13400E+02    (n.mi)
  CURRENT AIRCRAFT GROSS WGHT GWTIME1      0.12967E+07    (lb)
  AMOUNT OF FUEL CONSUMED      FUELTI1     0.26612E+05    (lb)
  CURRENT ENGINE THRUST        THRSTI1     0.52307E+06    (lbst)
  FLOPS SPECIFIC FUEL CONSUM. SFCFL1       0.10101E+01    (lb/lbt/hr)
  CURRENT FUEL FLOW RATE       FLOWFL1     0.52832E+06    (lb/hr)
  TIME SINCE TAKEOFF           TIME1       0.13770E+02    (min)
  CURRENT ALTITUDE             ALTIME1     0.22952E+05    (ft)
  CURRENT SPEED (MACH NUMBER) TIMACH1      0.87310E+00
  DISTANCE TRAVELED SOFAR      DIST1       0.19900E+02    (n.mi)
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Listing of "*neutral.file*" (Continued)

CURRENT AIRCRAFT GROSS WGHT	GWTIME1	0.12920E+07	(lb)
AMOUNT OF FUEL CONSUMED	FUELTI1	0.31361E+05	(lb)
CURRENT ENGINE THRUST	THRSTI1	0.32676E+06	(lbst)
FLOPS SPECIFIC FUEL CONSUM.	SFCFL1	0.96330E+00	(lb/lbt/hr)
CURRENT FUEL FLOW RATE	FLOWFL1	0.31477E+06	(lb/hr)
TIME SINCE TAKEOFF	TIME1	0.14610E+02	(min)
CURRENT ALTITUDE	ALTIME1	0.19285E+05	(ft)
CURRENT SPEED (MACH NUMBER)	TIMACH1	0.12665E+01	
DISTANCE TRAVELED SOFAR	DIST1	0.29000E+02	(n.mi)
CURRENT AIRCRAFT GROSS WGHT	GWTIME1	0.12865E+07	(lb)
AMOUNT OF FUEL CONSUMED	FUELTI1	0.36861E+05	(lb)
CURRENT ENGINE THRUST	THRSTI1	0.52238E+06	(lbst)
FLOPS SPECIFIC FUEL CONSUM.	SFCFL1	0.10764E+01	(lb/lbt/hr)
CURRENT FUEL FLOW RATE	FLOWFL1	0.56231E+06	(lb/hr)
TIME SINCE TAKEOFF	TIME1	0.15240E+02	(min)
CURRENT ALTITUDE	ALTIME1	0.20461E+05	(ft)
CURRENT SPEED (MACH NUMBER)	TIMACH1	0.14833E+01	
DISTANCE TRAVELED SOFAR	DIST1	0.37900E+02	(n.mi)
CURRENT AIRCRAFT GROSS WGHT	GWTIME1	0.12807E+07	(lb)
AMOUNT OF FUEL CONSUMED	FUELTI1	0.42657E+05	(lb)
CURRENT ENGINE THRUST	THRSTI1	0.57783E+06	(lbst)
FLOPS SPECIFIC FUEL CONSUM.	SFCFL1	0.11347E+01	(lb/lbt/hr)
CURRENT FUEL FLOW RATE	FLOWFL1	0.65565E+06	(lb/hr)
TIME SINCE TAKEOFF	TIME1	0.15740E+02	(min)
CURRENT ALTITUDE	ALTIME1	0.23737E+05	(ft)
CURRENT SPEED (MACH NUMBER)	TIMACH1	0.16512E+01	
DISTANCE TRAVELED SOFAR	DIST1	0.45900E+02	(n.mi)
CURRENT AIRCRAFT GROSS WGHT	GWTIME1	0.12754E+07	(lb)
AMOUNT OF FUEL CONSUMED	FUELTI1	0.47898E+05	(lb)
CURRENT ENGINE THRUST	THRSTI1	0.64706E+06	(lbst)
FLOPS SPECIFIC FUEL CONSUM.	SFCFL1	0.11410E+01	(lb/lbt/hr)
CURRENT FUEL FLOW RATE	FLOWFL1	0.73831E+06	(lb/hr)
TIME SINCE TAKEOFF	TIME1	0.16170E+02	(min)
CURRENT ALTITUDE	ALTIME1	0.28167E+05	(ft)
CURRENT SPEED (MACH NUMBER)	TIMACH1	0.18000E+01	
DISTANCE TRAVELED SOFAR	DIST1	0.53200E+02	(n.mi)
CURRENT AIRCRAFT GROSS WGHT	GWTIME1	0.12708E+07	(lb)
AMOUNT OF FUEL CONSUMED	FUELTI1	0.52532E+05	(lb)
CURRENT ENGINE THRUST	THRSTI1	0.62549E+06	(lbst)
FLOPS SPECIFIC FUEL CONSUM.	SFCFL1	0.11329E+01	(lb/lbt/hr)
CURRENT FUEL FLOW RATE	FLOWFL1	0.70861E+06	(lb/hr)
TIME SINCE TAKEOFF	TIME1	0.16620E+02	(min)
CURRENT ALTITUDE	ALTIME1	0.33796E+05	(ft)
CURRENT SPEED (MACH NUMBER)	TIMACH1	0.19375E+01	
DISTANCE TRAVELED SOFAR	DIST1	0.61400E+02	(n.mi)
CURRENT AIRCRAFT GROSS WGHT	GWTIME1	0.12663E+07	(lb)
AMOUNT OF FUEL CONSUMED	FUELTI1	0.57010E+05	(lb)
CURRENT ENGINE THRUST	THRSTI1	0.53250E+06	(lbst)
FLOPS SPECIFIC FUEL CONSUM.	SFCFL1	0.11538E+01	(lb/lbt/hr)
CURRENT FUEL FLOW RATE	FLOWFL1	0.61441E+06	(lb/hr)
TIME SINCE TAKEOFF	TIME1	0.17130E+02	(min)
CURRENT ALTITUDE	ALTIME1	0.37748E+05	(ft)
CURRENT SPEED (MACH NUMBER)	TIMACH1	0.20756E+01	
DISTANCE TRAVELED SOFAR	DIST1	0.71200E+02	(n.mi)
CURRENT AIRCRAFT GROSS WGHT	GWTIME1	0.12618E+07	(lb)
AMOUNT OF FUEL CONSUMED	FUELTI1	0.61548E+05	(lb)
CURRENT ENGINE THRUST	THRSTI1	0.48485E+06	(lbst)
FLOPS SPECIFIC FUEL CONSUM.	SFCFL1	0.11747E+01	(lb/lbt/hr)
CURRENT FUEL FLOW RATE	FLOWFL1	0.56956E+06	(lb/hr)
TIME SINCE TAKEOFF	TIME1	0.17710E+02	(min)
CURRENT ALTITUDE	ALTIME1	0.41870E+05	(ft)

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  CURRENT SPEED (MACH NUMBER) TIMACH1      0.21840E+01
  DISTANCE TRAVELED SOFAR     DIST1        0.83100E+02    (n.mi)
  CURRENT AIRCRAFT GROSS WGHT GWTIME1      0.12571E+07    (lb)
  AMOUNT OF FUEL CONSUMED     FUELTI1      0.66222E+05    (lb)
  CURRENT ENGINE THRUST       THRSTI1      0.41840E+06    (lbst)
  FLOPS SPECIFIC FUEL CONSUM. SFCFL1       0.11920E+01    (lb/lbt/hr)
  CURRENT FUEL FLOW RATE      FLOWFL1      0.49872E+06    (lb/hr)
  TIME SINCE TAKEOFF          TIME1        0.18410E+02    (min)
  CURRENT ALTITUDE            ALTIME1      0.43898E+05    (ft)
  CURRENT SPEED (MACH NUMBER) TIMACH1      0.23185E+01
  DISTANCE TRAVELED SOFAR     DIST1        0.98000E+02    (n.mi)
  CURRENT AIRCRAFT GROSS WGHT GWTIME1      0.12521E+07    (lb)
  AMOUNT OF FUEL CONSUMED     FUELTI1      0.71264E+05    (lb)
  CURRENT ENGINE THRUST       THRSTI1      0.38936E+06    (lbst)
  FLOPS SPECIFIC FUEL CONSUM. SFCFL1       0.12133E+01    (lb/lbt/hr)
  CURRENT FUEL FLOW RATE      FLOWFL1      0.47241E+06    (lb/hr)
  TIME SINCE TAKEOFF          TIME1        0.19270E+02    (min)
  CURRENT ALTITUDE            ALTIME1      0.49150E+05    (ft)
  CURRENT SPEED (MACH NUMBER) TIMACH1      0.24000E+01
  DISTANCE TRAVELED SOFAR     DIST1        0.11750E+03    (n.mi)
  CURRENT AIRCRAFT GROSS WGHT GWTIME1      0.12464E+07    (lb)
  AMOUNT OF FUEL CONSUMED     FUELTI1      0.76911E+05    (lb)
  CURRENT ENGINE THRUST       THRSTI1      0.32196E+06    (lbst)
  FLOPS SPECIFIC FUEL CONSUM. SFCFL1       0.12267E+01    (lb/lbt/hr)
  CURRENT FUEL FLOW RATE      FLOWFL1      0.39496E+06    (lb/hr)
  TIME SINCE TAKEOFF          TIME1        0.20790E+02    (min)
  CURRENT ALTITUDE            ALTIME1      0.58049E+05    (ft)
  CURRENT SPEED (MACH NUMBER) TIMACH1      0.24000E+01
  DISTANCE TRAVELED SOFAR     DIST1        0.15220E+03    (n.mi)
  CURRENT AIRCRAFT GROSS WGHT GWTIME1      0.12390E+07    (lb)
  AMOUNT OF FUEL CONSUMED     FUELTI1      0.84359E+05    (lb)
  CURRENT ENGINE THRUST       THRSTI1      0.21209E+06    (lbst)
  FLOPS SPECIFIC FUEL CONSUM. SFCFL1       0.12303E+01    (lb/lbt/hr)
  CURRENT FUEL FLOW RATE      FLOWFL1      0.26093E+06    (lb/hr)
FLOPS SEGMENT 2 CRUISE DETAILED FLIGHT DATA
  TIME SINCE TAKEOFF          TIME2        0.20790E+02    (min)
  CURRENT ALTITUDE            ALTIME2      0.58049E+05    (ft)
  CURRENT SPEED (MACH NUMBER) TIMACH2      0.24000E+01
  DISTANCE TRAVELED SOFAR     DIST2        0.15220E+03    (n.mi)
  CURRENT AIRCRAFT GROSS WGHT GWTIME2      0.12390E+07    (lb)
  AMOUNT OF FUEL CONSUMED     FUELTI2      0.84359E+05    (lb)
  CURRENT ENGINE THRUST       THRSTI2      0.20074E+06    (lbst)
  FLOPS SPECIFIC FUEL CONSUM. SFCFL2       0.11066E+01    (lb/lbt/hr)
  CURRENT FUEL FLOW RATE      FLOWFL2      0.22214E+06    (lb/hr)
  TIME SINCE TAKEOFF          TIME2        0.31460E+02    (min)
  CURRENT ALTITUDE            ALTIME2      0.58653E+05    (ft)
  CURRENT SPEED (MACH NUMBER) TIMACH2      0.24000E+01
  DISTANCE TRAVELED SOFAR     DIST2        0.39710E+03    (n.mi)
  CURRENT AIRCRAFT GROSS WGHT GWTIME2      0.12000E+07    (lb)
  AMOUNT OF FUEL CONSUMED     FUELTI2      0.12334E+06    (lb)
  CURRENT ENGINE THRUST       THRSTI2      0.19469E+06    (lbst)
  FLOPS SPECIFIC FUEL CONSUM. SFCFL2       0.11071E+01    (lb/lbt/hr)
  CURRENT FUEL FLOW RATE      FLOWFL2      0.21553E+06    (lb/hr)
  TIME SINCE TAKEOFF          TIME2        0.45660E+02    (min)
  CURRENT ALTITUDE            ALTIME2      0.59426E+05    (ft)
  CURRENT SPEED (MACH NUMBER) TIMACH2      0.24000E+01
  DISTANCE TRAVELED SOFAR     DIST2        0.72280E+03    (n.mi)
  CURRENT AIRCRAFT GROSS WGHT GWTIME2      0.11500E+07    (lb)
  AMOUNT OF FUEL CONSUMED     FUELTI2      0.17334E+06    (lb)
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Listing of "*neutral.file*" (Continued)

CURRENT ENGINE THRUST	THRSTI2	0.18695E+06	(lbst)
FLOPS SPECIFIC FUEL CONSUM.	SFCFL2	0.11077E+01	(lb/lbt/hr)
CURRENT FUEL FLOW RATE	FLOWFL2	0.20708E+06	(lb/hr)
TIME SINCE TAKEOFF	TIME2	0.60450E+02	(min)
CURRENT ALTITUDE	ALTIME2	0.60000E+05	(ft)
CURRENT SPEED (MACH NUMBER)	TIMACH2	0.24000E+01	
DISTANCE TRAVELED SOFAR	DIST2	0.10621E+04	(n.mi)
CURRENT AIRCRAFT GROSS WGHT	GWTIME2	0.11000E+07	(lb)
AMOUNT OF FUEL CONSUMED	FUELTI2	0.22334E+06	(lb)
CURRENT ENGINE THRUST	THRSTI2	0.17937E+06	(lbst)
FLOPS SPECIFIC FUEL CONSUM.	SFCFL2	0.11078E+01	(lb/lbt/hr)
CURRENT FUEL FLOW RATE	FLOWFL2	0.19871E+06	(lb/hr)
TIME SINCE TAKEOFF	TIME2	0.75850E+02	(min)
CURRENT ALTITUDE	ALTIME2	0.60000E+05	(ft)
CURRENT SPEED (MACH NUMBER)	TIMACH2	0.24000E+01	
DISTANCE TRAVELED SOFAR	DIST2	0.14156E+04	(n.mi)
CURRENT AIRCRAFT GROSS WGHT	GWTIME2	0.10500E+07	(lb)
AMOUNT OF FUEL CONSUMED	FUELTI2	0.27334E+06	(lb)
CURRENT ENGINE THRUST	THRSTI2	0.17247E+06	(lbst)
FLOPS SPECIFIC FUEL CONSUM.	SFCFL2	0.11064E+01	(lb/lbt/hr)
CURRENT FUEL FLOW RATE	FLOWFL2	0.19083E+06	(lb/hr)
TIME SINCE TAKEOFF	TIME2	0.91890E+02	(min)
CURRENT ALTITUDE	ALTIME2	0.60000E+05	(ft)
CURRENT SPEED (MACH NUMBER)	TIMACH2	0.24000E+01	
DISTANCE TRAVELED SOFAR	DIST2	0.17834E+04	(n.mi)
CURRENT AIRCRAFT GROSS WGHT	GWTIME2	0.10000E+07	(lb)
AMOUNT OF FUEL CONSUMED	FUELTI2	0.32334E+06	(lb)
CURRENT ENGINE THRUST	THRSTI2	0.16599E+06	(lbst)
FLOPS SPECIFIC FUEL CONSUM.	SFCFL2	0.11051E+01	(lb/lbt/hr)
CURRENT FUEL FLOW RATE	FLOWFL2	0.18343E+06	(lb/hr)
TIME SINCE TAKEOFF	TIME2	0.10856E+03	(min)
CURRENT ALTITUDE	ALTIME2	0.60000E+05	(ft)
CURRENT SPEED (MACH NUMBER)	TIMACH2	0.24000E+01	
DISTANCE TRAVELED SOFAR	DIST2	0.21659E+04	(n.mi)
CURRENT AIRCRAFT GROSS WGHT	GWTIME2	0.95000E+06	(lb)
AMOUNT OF FUEL CONSUMED	FUELTI2	0.37334E+06	(lb)
CURRENT ENGINE THRUST	THRSTI2	0.15992E+06	(lbst)
FLOPS SPECIFIC FUEL CONSUM.	SFCFL2	0.11036E+01	(lb/lbt/hr)
CURRENT FUEL FLOW RATE	FLOWFL2	0.17649E+06	(lb/hr)
TIME SINCE TAKEOFF	TIME2	0.12586E+03	(min)
CURRENT ALTITUDE	ALTIME2	0.60000E+05	(ft)
CURRENT SPEED (MACH NUMBER)	TIMACH2	0.24000E+01	
DISTANCE TRAVELED SOFAR	DIST2	0.25628E+04	(n.mi)
CURRENT AIRCRAFT GROSS WGHT	GWTIME2	0.90000E+06	(lb)
AMOUNT OF FUEL CONSUMED	FUELTI2	0.42334E+06	(lb)
CURRENT ENGINE THRUST	THRSTI2	0.15426E+06	(lbst)
FLOPS SPECIFIC FUEL CONSUM.	SFCFL2	0.11048E+01	(lb/lbt/hr)
CURRENT FUEL FLOW RATE	FLOWFL2	0.17042E+06	(lb/hr)
TIME SINCE TAKEOFF	TIME2	0.14376E+03	(min)
CURRENT ALTITUDE	ALTIME2	0.60000E+05	(ft)
CURRENT SPEED (MACH NUMBER)	TIMACH2	0.24000E+01	
DISTANCE TRAVELED SOFAR	DIST2	0.29734E+04	(n.mi)
CURRENT AIRCRAFT GROSS WGHT	GWTIME2	0.85000E+06	(lb)
AMOUNT OF FUEL CONSUMED	FUELTI2	0.47334E+06	(lb)
CURRENT ENGINE THRUST	THRSTI2	0.14902E+06	(lbst)
FLOPS SPECIFIC FUEL CONSUM.	SFCFL2	0.11060E+01	(lb/lbt/hr)
CURRENT FUEL FLOW RATE	FLOWFL2	0.16481E+06	(lb/hr)
TIME SINCE TAKEOFF	TIME2	0.16225E+03	(min)
CURRENT ALTITUDE	ALTIME2	0.60000E+05	(ft)
CURRENT SPEED (MACH NUMBER)	TIMACH2	0.24000E+01	
DISTANCE TRAVELED SOFAR	DIST2	0.33978E+04	(n.mi)
CURRENT AIRCRAFT GROSS WGHT	GWTIME2	0.80000E+06	(lb)

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  AMOUNT OF FUEL CONSUMED      FUELTI2     0.52334E+06    (lb)
  CURRENT ENGINE THRUST        THRSTI2     0.14413E+06    (lbst)
  FLOPS SPECIFIC FUEL CONSUM.  SFCFL2      0.11072E+01    (lb/lbt/hr)
  CURRENT FUEL FLOW RATE       FLOWFL2     0.15958E+06    (lb/hr)
  TIME SINCE TAKEOFF           TIME2       0.18134E+03    (min)
  CURRENT ALTITUDE             ALTIME2     0.60000E+05    (ft)
  CURRENT SPEED (MACH NUMBER)  TIMACH2     0.24000E+01
  DISTANCE TRAVELED SOFAR      DIST2       0.38357E+04    (n.mi)
  CURRENT AIRCRAFT GROSS WGHT  GWTIME2     0.75000E+06    (lb)
  AMOUNT OF FUEL CONSUMED      FUELTI2     0.57334E+06    (lb)
  CURRENT ENGINE THRUST        THRSTI2     0.13967E+06    (lbst)
  FLOPS SPECIFIC FUEL CONSUM.  SFCFL2      0.11084E+01    (lb/lbt/hr)
  CURRENT FUEL FLOW RATE       FLOWFL2     0.15480E+06    (lb/hr)
  TIME SINCE TAKEOFF           TIME2       0.20099E+03    (min)
  CURRENT ALTITUDE             ALTIME2     0.60000E+05    (ft)
  CURRENT SPEED (MACH NUMBER)  TIMACH2     0.24000E+01
  DISTANCE TRAVELED SOFAR      DIST2       0.42866E+04    (n.mi)
  CURRENT AIRCRAFT GROSS WGHT  GWTIME2     0.70000E+06    (lb)
  AMOUNT OF FUEL CONSUMED      FUELTI2     0.62334E+06    (lb)
  CURRENT ENGINE THRUST        THRSTI2     0.13564E+06    (lbst)
  FLOPS SPECIFIC FUEL CONSUM.  SFCFL2      0.11095E+01    (lb/lbt/hr)
  CURRENT FUEL FLOW RATE       FLOWFL2     0.15050E+06    (lb/hr)
  TIME SINCE TAKEOFF           TIME2       0.22118E+03    (min)
  CURRENT ALTITUDE             ALTIME2     0.60000E+05    (ft)
  CURRENT SPEED (MACH NUMBER)  TIMACH2     0.24000E+01
  DISTANCE TRAVELED SOFAR      DIST2       0.47498E+04    (n.mi)
  CURRENT AIRCRAFT GROSS WGHT  GWTIME2     0.65000E+06    (lb)
  AMOUNT OF FUEL CONSUMED      FUELTI2     0.67334E+06    (lb)
  CURRENT ENGINE THRUST        THRSTI2     0.13206E+06    (lbst)
  FLOPS SPECIFIC FUEL CONSUM.  SFCFL2      0.11110E+01    (lb/lbt/hr)
  CURRENT FUEL FLOW RATE       FLOWFL2     0.14671E+06    (lb/hr)
  TIME SINCE TAKEOFF           TIME2       0.23170E+03    (min)
  CURRENT ALTITUDE             ALTIME2     0.60000E+05    (ft)
  CURRENT SPEED (MACH NUMBER)  TIMACH2     0.24000E+01
  DISTANCE TRAVELED SOFAR      DIST2       0.49911E+04    (n.mi)
  CURRENT AIRCRAFT GROSS WGHT  GWTIME2     0.62444E+06    (lb)
  AMOUNT OF FUEL CONSUMED      FUELTI2     0.69890E+06    (lb)
  CURRENT ENGINE THRUST        THRSTI2     0.13040E+06    (lbst)
  FLOPS SPECIFIC FUEL CONSUM.  SFCFL2      0.11117E+01    (lb/lbt/hr)
  CURRENT FUEL FLOW RATE       FLOWFL2     0.14496E+06    (lb/hr)
FLOPS SEGMENT 3 DESCENT DETAILED FLIGHT DATA
  TIME SINCE TAKEOFF           TIME3       0.23170E+03    (min)
  CURRENT ALTITUDE             ALTIME3     0.60000E+05    (ft)
  CURRENT SPEED (MACH NUMBER)  TIMACH3     0.24000E+01
  DISTANCE TRAVELED SOFAR      DIST3       0.49911E+04    (n.mi)
  CURRENT AIRCRAFT GROSS WGHT  GWTIME3     0.62444E+06    (lb)
  AMOUNT OF FUEL CONSUMED      FUELTI3     0.69890E+06    (lb)
  CURRENT ENGINE THRUST        THRSTI3     0.00000E+00    (lbst)
  FLOPS SPECIFIC FUEL CONSUM.  SFCFL3      0.00000E+00    (lb/lbt/hr)
  CURRENT FUEL FLOW RATE       FLOWFL3     0.18869E+05    (lb/hr)
  TIME SINCE TAKEOFF           TIME3       0.23210E+03    (min)
  CURRENT ALTITUDE             ALTIME3     0.60000E+05    (ft)
  CURRENT SPEED (MACH NUMBER)  TIMACH3     0.22394E+01
  DISTANCE TRAVELED SOFAR      DIST3       0.50000E+04    (n.mi)
  CURRENT AIRCRAFT GROSS WGHT  GWTIME3     0.62433E+06    (lb)
  AMOUNT OF FUEL CONSUMED      FUELTI3     0.69901E+06    (lb)
  CURRENT ENGINE THRUST        THRSTI3     0.00000E+00    (lbst)
  FLOPS SPECIFIC FUEL CONSUM.  SFCFL3      0.00000E+00    (lb/lbt/hr)
  CURRENT FUEL FLOW RATE       FLOWFL3     0.17446E+05    (lb/hr)
  TIME SINCE TAKEOFF           TIME3       0.23257E+03    (min)
  CURRENT ALTITUDE             ALTIME3     0.60000E+05    (ft)
  CURRENT SPEED (MACH NUMBER)  TIMACH3     0.20664E+01
```

Listing of "*neutral.file*" (Continued)

DISTANCE TRAVELED SOFAR	DIST3	0.50097E+04	(n.mi)
CURRENT AIRCRAFT GROSS WGHT	GWTIME3	0.62421E+06	(lb)
AMOUNT OF FUEL CONSUMED	FUELTI3	0.69913E+06	(lb)
CURRENT ENGINE THRUST	THRSTI3	0.00000E+00	(lbst)
FLOPS SPECIFIC FUEL CONSUM.	SFCFL3	0.00000E+00	(lb/lbt/hr)
CURRENT FUEL FLOW RATE	FLOWFL3	0.15885E+05	(lb/hr)
TIME SINCE TAKEOFF	TIME3	0.23314E+03	(min)
CURRENT ALTITUDE	ALTIME3	0.60000E+05	(ft)
CURRENT SPEED (MACH NUMBER)	TIMACH3	0.18775E+01	
DISTANCE TRAVELED SOFAR	DIST3	0.50204E+04	(n.mi)
CURRENT AIRCRAFT GROSS WGHT	GWTIME3	0.62408E+06	(lb)
AMOUNT OF FUEL CONSUMED	FUELTI3	0.69926E+06	(lb)
CURRENT ENGINE THRUST	THRSTI3	0.00000E+00	(lbst)
FLOPS SPECIFIC FUEL CONSUM.	SFCFL3	0.00000E+00	(lb/lbt/hr)
CURRENT FUEL FLOW RATE	FLOWFL3	0.14056E+05	(lb/hr)
TIME SINCE TAKEOFF	TIME3	0.23384E+03	(min)
CURRENT ALTITUDE	ALTIME3	0.60000E+05	(ft)
CURRENT SPEED (MACH NUMBER)	TIMACH3	0.16674E+01	
DISTANCE TRAVELED SOFAR	DIST3	0.50322E+04	(n.mi)
CURRENT AIRCRAFT GROSS WGHT	GWTIME3	0.62395E+06	(lb)
AMOUNT OF FUEL CONSUMED	FUELTI3	0.69939E+06	(lb)
CURRENT ENGINE THRUST	THRSTI3	0.00000E+00	(lbst)
FLOPS SPECIFIC FUEL CONSUM.	SFCFL3	0.00000E+00	(lb/lbt/hr)
CURRENT FUEL FLOW RATE	FLOWFL3	0.11422E+05	(lb/hr)
TIME SINCE TAKEOFF	TIME3	0.23471E+03	(min)
CURRENT ALTITUDE	ALTIME3	0.59344E+05	(ft)
CURRENT SPEED (MACH NUMBER)	TIMACH3	0.14423E+01	
DISTANCE TRAVELED SOFAR	DIST3	0.50452E+04	(n.mi)
CURRENT AIRCRAFT GROSS WGHT	GWTIME3	0.62380E+06	(lb)
AMOUNT OF FUEL CONSUMED	FUELTI3	0.69954E+06	(lb)
CURRENT ENGINE THRUST	THRSTI3	0.00000E+00	(lbst)
FLOPS SPECIFIC FUEL CONSUM.	SFCFL3	0.00000E+00	(lb/lbt/hr)
CURRENT FUEL FLOW RATE	FLOWFL3	0.11230E+05	(lb/hr)
TIME SINCE TAKEOFF	TIME3	0.23584E+03	(min)
CURRENT ALTITUDE	ALTIME3	0.60000E+05	(ft)
CURRENT SPEED (MACH NUMBER)	TIMACH3	0.11358E+01	
DISTANCE TRAVELED SOFAR	DIST3	0.50591E+04	(n.mi)
CURRENT AIRCRAFT GROSS WGHT	GWTIME3	0.62359E+06	(lb)
AMOUNT OF FUEL CONSUMED	FUELTI3	0.69975E+06	(lb)
CURRENT ENGINE THRUST	THRSTI3	0.00000E+00	(lbst)
FLOPS SPECIFIC FUEL CONSUM.	SFCFL3	0.00000E+00	(lb/lbt/hr)
CURRENT FUEL FLOW RATE	FLOWFL3	0.14280E+05	(lb/hr)
TIME SINCE TAKEOFF	TIME3	0.23738E+03	(min)
CURRENT ALTITUDE	ALTIME3	0.54794E+05	(ft)
CURRENT SPEED (MACH NUMBER)	TIMACH3	0.95000E+00	
DISTANCE TRAVELED SOFAR	DIST3	0.50745E+04	(n.mi)
CURRENT AIRCRAFT GROSS WGHT	GWTIME3	0.62328E+06	(lb)
AMOUNT OF FUEL CONSUMED	FUELTI3	0.70005E+06	(lb)
CURRENT ENGINE THRUST	THRSTI3	0.00000E+00	(lbst)
FLOPS SPECIFIC FUEL CONSUM.	SFCFL3	0.00000E+00	(lb/lbt/hr)
CURRENT FUEL FLOW RATE	FLOWFL3	0.11774E+05	(lb/hr)
TIME SINCE TAKEOFF	TIME3	0.23975E+03	(min)
CURRENT ALTITUDE	ALTIME3	0.46558E+05	(ft)
CURRENT SPEED (MACH NUMBER)	TIMACH3	0.85040E+00	
DISTANCE TRAVELED SOFAR	DIST3	0.50948E+04	(n.mi)
CURRENT AIRCRAFT GROSS WGHT	GWTIME3	0.62285E+06	(lb)
AMOUNT OF FUEL CONSUMED	FUELTI3	0.70048E+06	(lb)
CURRENT ENGINE THRUST	THRSTI3	0.00000E+00	(lbst)
FLOPS SPECIFIC FUEL CONSUM.	SFCFL3	0.00000E+00	(lb/lbt/hr)
CURRENT FUEL FLOW RATE	FLOWFL3	0.12495E+05	(lb/hr)
TIME SINCE TAKEOFF	TIME3	0.24344E+03	(min)
CURRENT ALTITUDE	ALTIME3	0.37054E+05	(ft)

```
  CURRENT SPEED (MACH NUMBER) TIMACH3     0.79410E+00
  DISTANCE TRAVELED SOFAR     DIST3       0.51238E+04    (n.mi)
  CURRENT AIRCRAFT GROSS WGHT GWTIME3     0.62211E+06    (lb)
  AMOUNT OF FUEL CONSUMED     FUELTI3     0.70123E+06    (lb)
  CURRENT ENGINE THRUST       THRSTI3     0.00000E+00    (lbst)
  FLOPS SPECIFIC FUEL CONSUM. SFCFL3      0.00000E+00    (lb/lbt/hr)
  CURRENT FUEL FLOW RATE      FLOWFL3     0.14323E+05    (lb/hr)
  TIME SINCE TAKEOFF          TIME3       0.24808E+03    (min)
  CURRENT ALTITUDE            ALTIME3     0.28661E+05    (ft)
  CURRENT SPEED (MACH NUMBER) TIMACH3     0.65760E+00
  DISTANCE TRAVELED SOFAR     DIST3       0.51564E+04    (n.mi)
  CURRENT AIRCRAFT GROSS WGHT GWTIME3     0.62091E+06    (lb)
  AMOUNT OF FUEL CONSUMED     FUELTI3     0.70242E+06    (lb)
  CURRENT ENGINE THRUST       THRSTI3     0.00000E+00    (lbst)
  FLOPS SPECIFIC FUEL CONSUM. SFCFL3      0.00000E+00    (lb/lbt/hr)
  CURRENT FUEL FLOW RATE      FLOWFL3     0.20072E+05    (lb/hr)
  TIME SINCE TAKEOFF          TIME3       0.25370E+03    (min)
  CURRENT ALTITUDE            ALTIME3     0.19829E+05    (ft)
  CURRENT SPEED (MACH NUMBER) TIMACH3     0.53060E+00
  DISTANCE TRAVELED SOFAR     DIST3       0.51899E+04    (n.mi)
  CURRENT AIRCRAFT GROSS WGHT GWTIME3     0.61923E+06    (lb)
  AMOUNT OF FUEL CONSUMED     FUELTI3     0.70410E+06    (lb)
  CURRENT ENGINE THRUST       THRSTI3     0.00000E+00    (lbst)
  FLOPS SPECIFIC FUEL CONSUM. SFCFL3      0.00000E+00    (lb/lbt/hr)
  CURRENT FUEL FLOW RATE      FLOWFL3     0.19761E+05    (lb/hr)
  TIME SINCE TAKEOFF          TIME3       0.26032E+03    (min)
  CURRENT ALTITUDE            ALTIME3     0.10000E+05    (ft)
  CURRENT SPEED (MACH NUMBER) TIMACH3     0.45220E+00
  DISTANCE TRAVELED SOFAR     DIST3       0.52238E+04    (n.mi)
  CURRENT AIRCRAFT GROSS WGHT GWTIME3     0.61683E+06    (lb)
  AMOUNT OF FUEL CONSUMED     FUELTI3     0.70651E+06    (lb)
  CURRENT ENGINE THRUST       THRSTI3     0.00000E+00    (lbst)
  FLOPS SPECIFIC FUEL CONSUM. SFCFL3      0.00000E+00    (lb/lbt/hr)
  CURRENT FUEL FLOW RATE      FLOWFL3     0.28815E+05    (lb/hr)
  TIME SINCE TAKEOFF          TIME3       0.26277E+03    (min)
  CURRENT ALTITUDE            ALTIME3     0.66670E+04    (ft)
  CURRENT SPEED (MACH NUMBER) TIMACH3     0.42560E+00
  DISTANCE TRAVELED SOFAR     DIST3       0.52353E+04    (n.mi)
  CURRENT AIRCRAFT GROSS WGHT GWTIME3     0.61568E+06    (lb)
  AMOUNT OF FUEL CONSUMED     FUELTI3     0.70766E+06    (lb)
  CURRENT ENGINE THRUST       THRSTI3     0.00000E+00    (lbst)
  FLOPS SPECIFIC FUEL CONSUM. SFCFL3      0.00000E+00    (lb/lbt/hr)
  CURRENT FUEL FLOW RATE      FLOWFL3     0.33624E+05    (lb/hr)
  TIME SINCE TAKEOFF          TIME3       0.26532E+03    (min)
  CURRENT ALTITUDE            ALTIME3     0.33330E+04    (ft)
  CURRENT SPEED (MACH NUMBER) TIMACH3     0.40090E+00
  DISTANCE TRAVELED SOFAR     DIST3       0.52467E+04    (n.mi)
  CURRENT AIRCRAFT GROSS WGHT GWTIME3     0.61430E+06    (lb)
  AMOUNT OF FUEL CONSUMED     FUELTI3     0.70904E+06    (lb)
  CURRENT ENGINE THRUST       THRSTI3     0.00000E+00    (lbst)
  FLOPS SPECIFIC FUEL CONSUM. SFCFL3      0.00000E+00    (lb/lbt/hr)
  CURRENT FUEL FLOW RATE      FLOWFL3     0.38363E+05    (lb/hr)
  TIME SINCE TAKEOFF          TIME3       0.26885E+03    (min)
  CURRENT ALTITUDE            ALTIME3     0.00000E+00    (ft)
  CURRENT SPEED (MACH NUMBER) TIMACH3     0.30000E+00
  DISTANCE TRAVELED SOFAR     DIST3       0.52603E+04    (n.mi)
  CURRENT AIRCRAFT GROSS WGHT GWTIME3     0.61218E+06    (lb)
  AMOUNT OF FUEL CONSUMED     FUELTI3     0.71116E+06    (lb)
  CURRENT ENGINE THRUST       THRSTI3     0.00000E+00    (lbst)
  FLOPS SPECIFIC FUEL CONSUM. SFCFL3      0.00000E+00    (lb/lbt/hr)
  CURRENT FUEL FLOW RATE      FLOWFL3     0.41482E+05    (lb/hr)
FLOPS AERO AND MISSION ANALYSIS SUMMARY
```

Listing of "*neutral.file*" (Continued)

FLOPS AIRCRAFT GROSS WEIGHT	GWFLTO	0.13233E+07	(lb)
FLOPS DESIGN MACH NUMBER	DESMAC	0.24000E+01	
FLOPS CRUISE VELOCITY	VFLOPS	0.15840E+04	(mi/hr)
FLOPS MAX. DYNAMIC PRESSURE	PRESSF	0.11040E+04	(psf)
FLOPS TOTAL RANGE	RGFLTO	0.57539E+04	(mi)
FLOPS BLOCK TIME	BTIMFL	0.46500E+01	(hr)
FLOPS BLOCK FUEL	BFUELF	0.71712E+06	(lb)
FLOPS AIRCRAFT COST ANALYSIS SUMMARY			
FLOPS WING WEIGHT	WINWGFL	0.15655E+06	(lb)
FLOPS WING COST	WINCOFL	0.94300E+07	($)
FLOPS TAIL WEIGHT	TAIWGFL	0.15068E+05	(lb)
FLOPS TAIL COST	TAICOFL	0.16510E+07	($)
FLOPS FUSELAGE WEIGHT	FUSWGFL	0.30911E+05	(lb)
FLOPS FUSELAGE COST	FUSCOFL	0.32410E+07	($)
FLOPS LANDING GEAR WEIGHT	LANWGFL	0.48569E+05	(lb)
FLOPS LANDING GEAR COST	LANCOFL	0.34590E+07	($)
FLOPS NACELLE WEIGHT	NACWGFL	0.37547E+05	(lb)
FLOPS NACELLE COST	NACCOFL	0.48570E+07	($)
FLOPS THRUST REVERSER WGHT	THRWGFL	0.36100E+04	(lb)
FLOPS THRUST REVERSER COST	THRCOFL	0.85000E+06	($)
FLOPS SURFACE CONTROL WGHT	SURWGFL	0.19435E+05	(lb)
FLOPS SURFACE CONTROL COST	SURCOFL	0.49180E+07	($)
FLOPS AUX POWER UNIT WEIGHT	AUXWGFL	0.12010E+04	(lb)
FLOPS AUX POWER UNIT COST	AUXCOFL	0.36000E+06	($)
FLOPS INSTRUMENTS WEIGHT	INSWGFL	0.13840E+04	(lb)
FLOPS INSTRUMENTS COST	INSCOFL	0.13560E+07	($)
FLOPS HYDRAULICS WEIGHT	HYDWGFL	0.33930E+04	(lb)
FLOPS HYDRAULICS COST	HYDCOFL	0.22800E+06	($)
FLOPS ELECTRICAL WEIGHT	ELEWGFL	0.37890E+04	(lb)
FLOPS ELECTRICAL COST	ELECOFL	0.83300E+06	($)
FLOPS AVIONICS WEIGHT	AVIWGFL	0.23120E+04	(lb)
FLOPS AVIONICS COST	AVICOFL	0.22650E+07	($)
FLOPS FURNISHING WEIGHT	FURWGFL	0.20403E+05	(lb)
FLOPS FURNISHING COST	FURCOFL	0.25690E+07	($)
FLOPS AIR CONDITION. WEIGHT	AIRWGFL	0.65300E+04	(lb)
FLOPS AIR CONDITION. COST	AIRCOFL	0.18860E+07	($)
FLOPS ANTI-ICING WEIGHT	ICEWGFL	0.43300E+03	(lb)
FLOPS ANTI-ICING COST	ICECOFL	0.12300E+06	($)
FLOPS PNEUMATIC WEIGHT	PNEWGFL	0.84800E+03	(lb)
FLOPS PNEUMATIC COST	PNECOFL	0.15800E+06	($)
FLOPS EMPTY WEIGHT	EMPWGFL	0.35967E+06	(lb) (LESS BARE ENGINES)
FLOPS TOTAL AIRFRAME COST	AIRTCOS	0.48885E+08	($)
FLOPS AIRFRAME R&D COST	RADCOST	0.26797E+10	($)
FLOPS DIRECT OPERATING COST FOR MATERIAL AND LABOR			
AIRFRAME INSPECT.MATERIAL	AIRMAT	0.35770E+02	($/departure)
AIRFRAME INSPECT.LABOR	AIRLAB	0.21862E+03	($/departure)
AIR CONDITIONING MATERIAL	ACMAT	0.13190E+02	($/departure)
AIR CONDITIONING LABOR	ACLAB	0.14410E+02	($/departure)
AUTOPILOT MATERIAL COST	AUTMAT	0.47600E+01	($/departure)
AUTOPILOT LABOR COST	AUTLAB	0.14940E+02	($/departure)
COMMUNICATIONS MATERIAL	COMMAT	0.80700E+01	($/departure)
COMMUNICATIONS LABOR COST	COMLAB	0.18870E+02	($/departure)
ELECTRICAL POWER MATERIAL	ELEMAT	0.29210E+02	($/departure)
ELECTRICAL POWER LABOR COST	ELELAB	0.21310E+02	($/departure)
EQUIPMENT & FURNISHINGS MAT	EQUMAT	0.29130E+02	($/departure)
EQUIPMENT & FURNISHINGS LAB	EQULAB	0.59870E+02	($/departure)
FIRE PROTECTION MATERIAL	FIRMAT	0.50700E+01	($/departure)
FIRE PROTECTION LABOR	FIRLAB	0.55700E+01	($/departure)
FLIGHT CONTROLS MATERIAL	FLIMAT	0.27020E+02	($/departure)
FLIGHT CONTROLS LABOR	FLILAB	0.30940E+02	($/departure)
FUEL MATERIAL	FUEMAT	0.11060E+02	($/departure)
FUEL LABOR	FUELAB	0.23000E+02	($/departure)

```
    HYDRAULIC POWER MATERIAL      HYDMAT      0.21080E+02     ($/departure)
    HYDRAULIC POWER LABOR         HYDLAB      0.14670E+02     ($/departure)
    ICE AND RAIN PROTECTION MAT   ICEMAT      0.74300E+01     ($/departure)
    ICE AND RAIN PROTECTION LAB   ICELAB      0.41500E+01     ($/departure)
    INSTRUMENTS MATERIAL          INSMAT      0.22400E+01     ($/departure)
    INSTRUMENTS LABOR             INSLAB      0.59000E+01     ($/departure)
    LANDING GEAR MATERIAL         LANMAT      0.29580E+03     ($/departure)
    LANDING GEAR LABOR            LANLAB      0.12289E+03     ($/departure)
    LIGHTING MATERIAL             LIGMAT      0.63200E+01     ($/departure)
    LIGHTING LABOR                LIGLAB      0.10440E+02     ($/departure)
    NAVIGATION MATERIAL           NAVMAT      0.12900E+02     ($/departure)
    NAVIGATION LABOR              NAVLAB      0.22360E+02     ($/departure)
    OXYGEN MATERIAL               OXYMAT      0.30100E+01     ($/departure)
    OXYGEN LABOR                  OXYLAB      0.34400E+01     ($/departure)
    PNEUMATICS MATERIAL           PNEMAT      0.18180E+02     ($/departure)
    PNEUMATICS GEAR LABOR         PNELAB      0.33800E+01     ($/departure)
    WATER/WASTE MATERIAL COST     WATMAT      0.28500E+01     ($/departure)
    WATER/WASTE LABOR COST        WATLAB      0.23500E+01     ($/departure)
    AIRBORNE AUXIL. POWER MAT.    AUXMAT      0.24850E+02     ($/departure)
    AIRBORNE AUXIL. POWER LABOR   AUXLAB      0.20020E+02     ($/departure)
    STRUCTURES MATERIAL COST      STRMAT      0.00000E+00     ($/departure)
    STRUCTURES LABOR COST         STRLAB      0.16130E+02     ($/departure)
    DOORS MATERIAL COST           DORMAT      0.63300E+01     ($/departure)
    DOORS LABOR COST              DORLAB      0.75900E+01     ($/departure)
    FUSELAGE MATERIAL COST        FUSMAT      0.18800E+01     ($/departure)
    FUSELAGE LABOR COST           FUSLAB      0.24970E+02     ($/departure)
    NACELLES MATERIAL COST        NACMAT      0.99000E+00     ($/departure)
    NACELLES LABOR COST           NACLAB      0.23900E+01     ($/departure)
    STABILIZERS MATERIAL COST     STAMAT      0.12000E+01     ($/departure)
    STABILIZERS LABOR COST        STALAB      0.26700E+01     ($/departure)
    WINDOWS MATERIAL COST         WINMAT      0.20200E+02     ($/departure)
    WINDOWS LABOR COST            WINLAB      0.30200E+01     ($/departure)
    WINGS MATERIAL COST           WIGMAT      0.14210E+02     ($/departure)
    WINGS LABOR COST              WIGLAB      0.94500E+01     ($/departure)
    AIRFRAME MAINTENANCE MAT.     AFRMAT      0.60274E+03     ($/departure)
    AIRFRAME MAINTENANCE LABOR    AFRLAB      0.68336E+03     ($/departure)
    PROPULSION SYSTEM MAINT.MAT   PROMAT      0.47004E+03     ($/departure)
    PROPULSION SYSTEM MAINT.LAB   PROLAB      0.42236E+03     ($/departure)
    MATERIAL COST SUBTOTAL        SUBMAT      0.24829E+04     ($/departure)
    DIRECT LABOR SUBTOTAL         SUBLAB      0.23728E+04     ($/departure)
    MAINTENANCE LABOR BURDEN      BURLAB      0.33219E+05     ($/departure)
    TOTAL MAINTENANCE/DEPARTURE   MAICOS      0.38075E+05     ($/departure)
 FLOPS REMAINING DIRECT OPERATING COST ELEMENT
    DEPRECIATION COST             DEPCOS      0.86438E+04     ($/departure)
    INSURANCE COST                RCECOS      0.98904E+03     ($/departure)
    AIRCRAFT SERVICING COST       SERCOS      0.18789E+04     ($/departure)
    FLIGHT CREW COST              CRECOS      0.43538E+04     ($/departure)
    FUEL COST                     FUECOS      0.53199E+05     ($/departure)
    LIFETIME DOC COST             LIFCOS      0.96638E+09     ($)
 FLOPS INDIRECT OPERATING COST
    GROUND PROPERTY/EQUIP. COST   GROCOS      0.59668E+04     ($/departure)
    CABIN CREW EXPENSES COST      CABCOS      0.16442E+04     ($/departure)
    PASSENGER FOOD & BEVERAGE     FABCOS      0.10718E+04     ($/departure)
    PASS. SERVICE SUPPORT COST    SUPCOS      0.88949E+04     ($/departure)
    AIRCRAFT CONTROL COST         CONCOS      0.67340E+02     ($/departure)
    PASSENGER HANDLING, RESERV.   HANCOS      0.14203E+04     ($/departure)
    BAGGAGE HANDLING COST         BAGCOS      0.38841E+03     ($/departure)
    CARGO HANDLING COST           CARCOS      0.00000E+00     ($/departure)
    FREIGHT SALES COST            SALCOS      0.00000E+00     ($/departure)
    GENERAL/ADMINISTRATIVE COST   ADMCOS      0.17703E+04     ($/departure)
    TOTAL INDIRECT OPERATING      INDCOS      0.21224E+05     ($/departure)
 FLOPS MISC. COST/PROFIT ELEMENTS
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Listing of "*neutral.file*" (Continued)

```
  FLOPS MANUFACTURING COST     MANCOS      0.70421E+08    ($)
  AIRFRAME SPARES COST         SPACOS      0.48880E+07    ($)
  ENGINES SPARES COST          SPECOS      0.44510E+07    ($)
  MANUFACTURERS PROFIT         MANPRO      0.11964E+08    ($)
  TOTAL ACQUISITION COST       ACQCOS      0.91725E+08    ($)
  TOTAL LIFE DOC               DOCLIF      0.96638E+09    ($)
  TOTAL LIFE INDIRECT OC       IOCLIF      0.19144E+09    ($)
  TOTAL LIFE CYCLE COST        CYCCOS      0.11578E+10    ($)
  TOTAL LIFE OPERATING COST    OPECOS      0.10799E+10    ($)
  RETURN ON INVESTMENT         ROIPER      0.70000E+01    (%)
  FARE COST                    FARCOS      0.12577E+04    ($/pass)
END FLOPS DATA
```

APPENDIX B

DESCRIPTION OF AIRFOIL DATA BANK

B.1 Airfoil Data Bank

The airfoil data bank file is named *airfoil.bank* and resides under the *tbest* directory. This file is required prior to the execution of T/BEST because the BLASIM and MTSB modules employ blade geometry for structural and transonic flow analyses. The BLASIM module provides the T/BEST neutral file with structural response parameters of the blade of rotating components. The MTSB module calculates the flow solution for the hub-shroud mid channel stream surface. General data about the blade such as: aspect ratio, and hub and tip radii are obtained from the NNEPWATE module. The input files to BLASIM and MTSB are generated by BLASIMGEN and MTSBGEN respectively.

The *airfoil.bank* file permits the construction of the blade according to the user's specification. It can accepts both airfoil definition as well as the full blade geometry (detailed airfoil). In this appendix, the data and format required to define a specific airfoil or a blade are described.

The user can build-up a library of airfoils in the data bank file to construct fan, compressor and turbine blades at each stage. In the T/BEST neutral file, one of two keywords, AIRCODE or ABLDEF, can be used for the definition of the blade geometry. Unless specified by the user, T/BEST uses a default airfoil "NACA 64-206 FAN" for fans/compressors and "NACA 64-206 TURBINE" for turbines. These selections may be modified as it demonstrated in section 3.3. The AIRCODE keyword is used to define a single basic airfoil for the construction of the whole blade while the ABLDEF keyword is used to define airfoils at all stations across the span of the blade. ABLDEF is left blank by default but when updated, T/BEST utilizes the full geometry for blade definition.

The airfoil data bank discussed here contains three set of NACA airfoils. Each set consists of two airfoils: the first for fans or compressors and the second for turbines. The three sets are: NACA 63A210, NACA 64-206, and NACA 66-206. Figure B.1 shows a plot of the airfoils used in the data bank. Note that these airfoils are used here for demonstration purposes. Also, the airfoil data bank file accepts full blade geometry (detailed airfoils at all stations). Figure B.2 shows the SR2 blade included in *airfoil.bank* which consists of 5 stations. The neck of the blade extends from the first to the second station. The airfoil input description is consistent with the one used in industry.

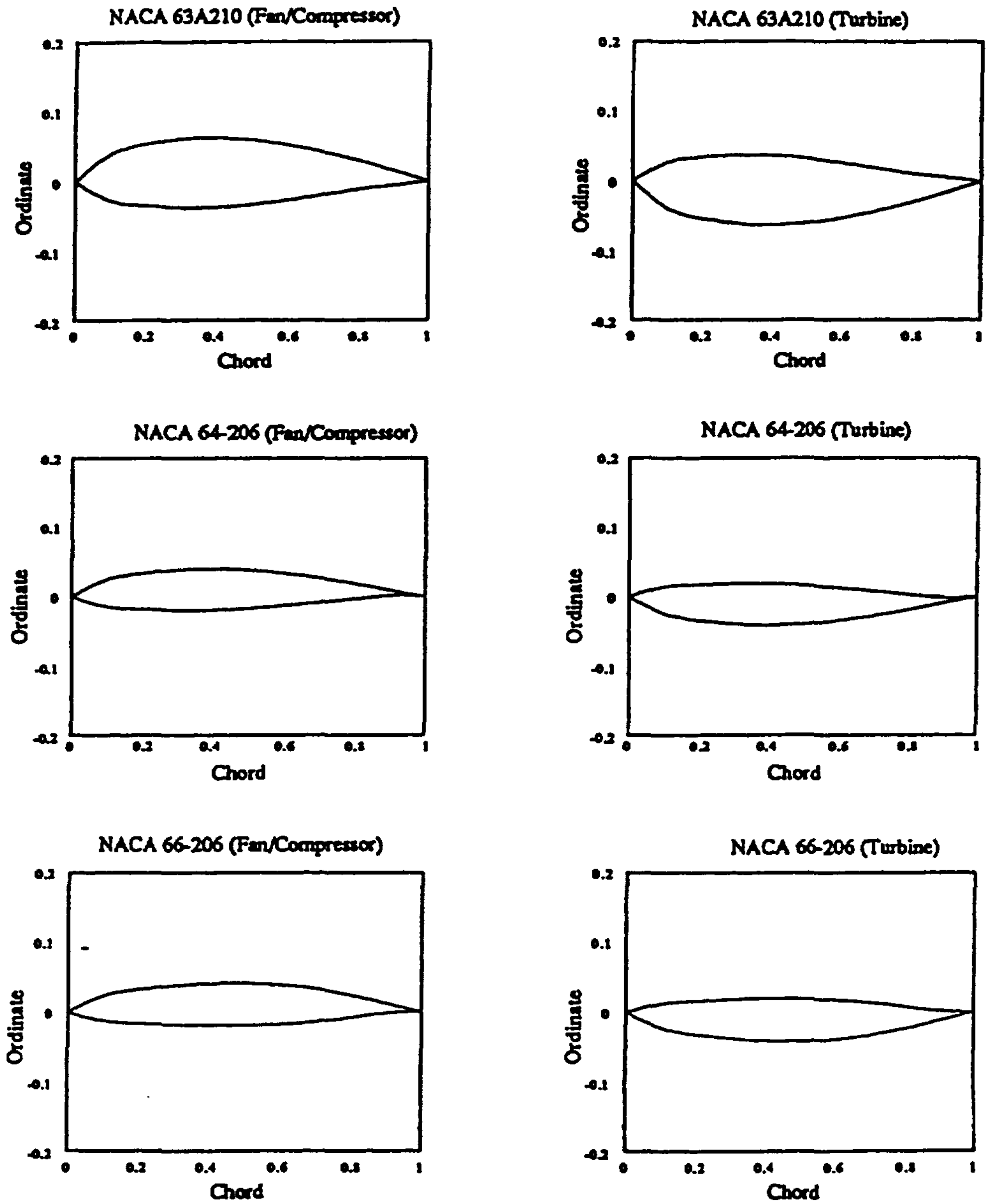

Figure B.1 T/BEST Airfoil Data Bank for Fan, Compressor and Turbine Blades

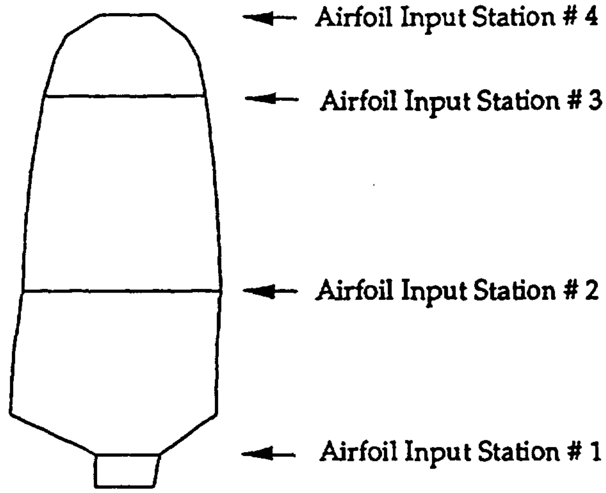

Figure B.2. Input Blade Details of an Unswept SR-2 Blade

The format of the airfoil data bank file is discussed next. Note that each data card is described by providing the variable name inside a rectangular box followed by an example. Also, the format required is noted as a subscript below the box.

B.2 Format of the Airfoil Data Bank

B.2.1 AIRFOIL DEFINITION Format

CARD A1

1 AIRDEF 18

AIRFOIL DEFINITION

Field	Item	Format	Description
1	AIRDEF	A18	Entry should be AIRFOIL DEFINITION.

CARD A2

1
AIRCODE
30

NACA 63A210 FAN

Field	Item	Format	Description
1	AIRCODE	A30	Keyword code name specific to the identification of the airfoil. The code name could be up to 30 characters length.

CARD A3

1	2	3	4
NSTA	NCOOR	STAGG	TROOT

11	11	35.0	6.0

Field	Item	Format	Description
1	NSTA	none	Number of airfoil stations that make up the blade.
2	NCOOR	none	Number of airfoil coordinates in a station.
3	STAGG	none	Stagger angle of the blade. Note that the same stagger angle will be used for all stations.
4	TROOT	none	Root thickness as a percentage of the chord. Always, the first station is used to estimate the root thickness as follows: (percentage)*(chord length of 1st station)

Note: When generating the blade model for BLASIM or MTSB, the same number of coordinates and stagger angle will be used for all stations.

CARD A4-a

Contents: axial airfoil coordinates

	1	2	3	4	5	6	7
X	X(1)	X(2)	X(3)	X(4)	X(5)	X(6)	X(7)
10	20	30	40	50	60	70	80

X	0.000	0.100	0.200	0.300	0.400	0.500	0.600

Field	Item	Format	Description
7 values per card	X	F	The x coordinates of the blade cross section given in ascending order for NO points in inches (Figure B.3).

CARD A4-b

Contents: Upper airfoil coordinates

	1	2	3	4	5	6	7
YUPPER	YU(1)	YU(2)	YU(3)	YU(4)	YU(5)	YU(6)	YU(7)
10	20	30	40	50	60	70	80

YUPPER	0.000	0.0245	00337	0.0388	0.0406	0.0387	0.0340

Field	Item	Format	Description
7 values per card	YUPPER	F	The upper y coordinates of the blade cross section corresponding to the x coordinates in inches (Figure B.3).

CARD A4-c

Contents: Lower airfoil coordinates

	1	2	3	4	5	6	7
YLOWER	YL(1)	YL(2)	YL(3)	YL(4)	YL(5)	YL(6)	YL(7)
10	20	30	40	50	60	70	80

YLOWER	0.000	0.0245	00337	0.0388	0.0406	0.0387	0.0340

Field	Item	Format	Description
7 values per card	YLOWER	F	The lower y coordinates of the blade cross section corresponding to the x coordinates in inches (Figure B.3).

Note: Data for CARDS A4-a , A4-b and A4-c are entered based on a percent of the chord. The data are later expanded when the blade model is generated: X = x*chord , YU = yupper*chord, and YL = ylower*chord

The station chord length is calculated for each station based on the mean chord length obtained form the *NNEPWATE* output.

B.2.2 FULL BLADE DEFINITION Format

CARD B1

1
AIRDEF
21

FULL BLADE DEFINITION

Field	Item	Format	Description
1	AIRDEF	A18	Entry should be FULL BLADE DEFINITION

CARD B2

1

ABLDEF

15

SR2 BLADE

Field	Item	Format	Description
1	ABLDEF	A15	Keyword code name specific to the identification of the blade. The code name could be up to 15 characters length.

CARD B3

1	2
NSTA	TROOT
5	1.08

Field	Item	Format	Description
1	NSTA	none	Number of airfoil stations that make up the blade.
2	TROOT	none	Root thickness in inches.

CARD B4

1	2	3
R(J)	ALPHA(J)	NO(J)

2.06	3.64	26

Field	Item	Format	Description
1	R	none	Distance from the engine center line to the blade station, inches. The first input station should be the blade attachment, the last the tip station.
2	ALPHA	none	Stagger angle or angle between plane of rotation of rotor stage and chord normal (y=0), degrees.
3	NO	none	The number of coordinate station along the chord used to describe the airfoil profile. Maximum of 53 points.

CARD B5

Contents: airfoil coordinates

	1	2	3	4	5	6	7	8
A6:	X(1)	X(2)	X(3)					
	8	16	24	32	40	48	56	

	1	2	3	4	5	6	7	8
A7:	YU(1)	YU(2)	YU(3)					
	8	16	24	32	40	48	56	

	1	2	3	4	5	6	7	
A8:	YL(1)	YL(2)	YL(3)					
	8	16	24	32	40	48	56	

0.000	0.128	0.256	0.384	0.512	0.639	0.767	0.895	1.023
0.000	0.103	0.122	0.120	0.108	0.089	0.065	0.036	0.000
0.000	-0.103	-0.122	-0.120	-0.108	-0.089	-0.065	-0.036	0.000

Field	Item	Format	Description
9 values per card. Fields of 8.	X	F	The x coordinates of the blade cross section given in ascending order for NO points in inches (Figure B.3).
Start each set on a card.	YU	F	The upper y coordinates of the blade cross section corresponding to the x coordinates in inches (Figure B.3).
	YL	F	The lower y coordinates of the blade cross section corresponding to the x coordinates in inches (Figure B.3).

Note: Repeat inputting CARDS B3 and B4 for all stations.

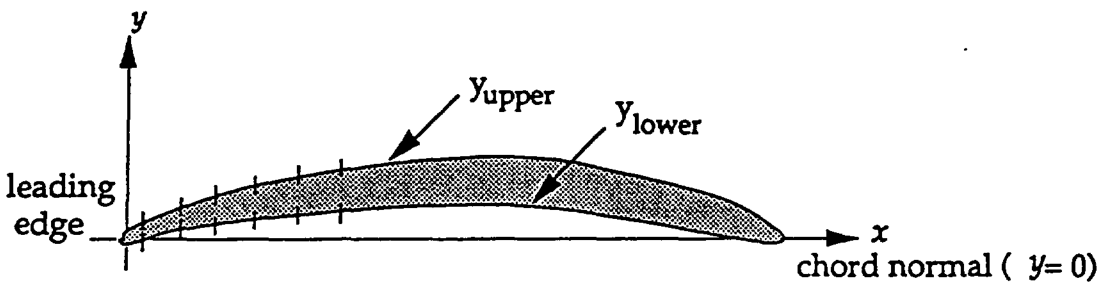

Figure B.3 1x2y Airfoil Section Coordinate Input

B.3 Listing of *airfoil.bank* file

```
AIRFOIL DEFINITION
NACA 63A210 FAN
11  11  35.0   6.0
X           0.00000   0.10000   0.20000   0.30000   0.40000   0.50000
0.60000
X           0.70000   0.80000   0.90000   1.00000
Y UPPER     0.00000   0.03939   0.05338   0.06063   0.06246   0.05943
0.05247
Y UPPER     0.04233   0.02984   0.01526   0.00021
Y LOWER     0.00000  -0.02709  -0.03461  -0.03762  -0.03690  -0.03283
-0.02639
Y LOWER    -0.01857  -0.01100  -0.00536  -0.00021

AIRFOIL DEFINITION
NACA 63A210 TURBINE
11  11  35.0   6.0
X           0.00000   0.10000   0.20000   0.30000   0.40000   0.50000
0.60000
X           0.70000   0.80000   0.90000   1.00000
Y UPPER     0.00000   0.02709   0.03461   0.03762   0.03690   0.03283
0.02639
Y UPPER     0.01857   0.01100   0.00536   0.00021
Y LOWER     0.00000  -0.03939  -0.05338  -0.06063  -0.06246  -0.05943
-0.05247
Y LOWER    -0.04233  -0.02984  -0.01526  -0.00021

AIRFOIL DEFINITION
NACA 64-206 FAN
11  11  35.0   6.0
X           0.00000   0.10000   0.20000   0.30000   0.40000   0.50000
0.60000
X           0.70000   0.80000   0.90000   1.00000
Y UPPER     0.00000   0.02451   0.03370   0.03880   0.04066   0.03878
0.03403
Y UPPER     0.02714   0.01870   0.00941   0.00000
Y LOWER     0.00000  -0.01406  -0.01773  -0.01935  -0.01924  -0.01672
-0.01259
Y LOWER    -0.00767  -0.00275   0.00094   0.00000

AIRFOIL DEFINITION
NACA 64-206 TURBINE
11  11  35.0   6.0
X           0.00000   0.10000   0.20000   0.30000   0.40000   0.50000
0.60000
X           0.70000   0.80000   0.90000   1.00000
Y UPPER     0.00000   0.01406   0.01773   0.01935   0.01924   0.01672
0.01259
Y UPPER     0.00767   0.00275  -0.00094   0.00000
Y LOWER     0.00000  -0.02451  -0.03370  -0.03880  -0.04066  -0.03878
-0.03403
Y LOWER    -0.02714  -0.01870  -0.00941   0.00000
```

```
AIRFOIL DEFINITION
NACA 66-206 FAN
11  11  35.0   6.0
X              0.00000    0.10000    0.20000    0.30000    0.40000    0.50000
0.60000
X              0.70000    0.80000    0.90000    1.00000
Y UPPER        0.00000    0.02274    0.03199    0.03755    0.04042    0.04088
0.03887
Y UPPER        0.03290    0.02342    0.01185    0.00000
Y LOWER        0.00000   -0.01231   -0.01602   -0.01809   -0.01899   -0.01743
-0.01342
Y LOWER       -0.00745   -0.00147    0.00000

AIRFOIL DEFINITION
NACA 66-206 TURBINE
11  11  35.0   6.0
X              0.00000    0.10000    0.20000    0.30000    0.40000    0.50000
0.60000
X              0.70000    0.80000    0.90000    1.00000
Y UPPER        0.00000    0.01231    0.01602    0.01809    0.01899    0.01743
0.01342
Y UPPER        0.00745    0.00147    0.00000
Y LOWER        0.00000   -0.02274   -0.03199   -0.03755   -0.04042   -0.04088
-0.03887
Y LOWER       -0.03290   -0.02342   -0.01185    0.00000

FULL BLADE DEFINITION
MODIFIED SR2 BL
 5   1.08
   2.060                    3.64                                26
   0.000   0.005   0.008   0.013   0.026   0.051   0.077   0.102   0.153
   0.205   0.256   0.307   0.358   0.409   0.460   0.512   0.563   0.614
   0.665   0.716   0.767   0.818   0.870   0.921   0.972   1.023
   0.000   0.012   0.015   0.018   0.025   0.035   0.042   0.049   0.058
   0.065   0.071   0.074   0.076   0.077   0.075   0.072   0.067   0.062
   0.056   0.048   0.040   0.031   0.021   0.012   0.005   0.000
   0.000  -0.012  -0.015  -0.018  -0.025  -0.035  -0.042  -0.049  -0.058
  -0.065  -0.071  -0.074  -0.076  -0.077  -0.075  -0.072  -0.067  -0.062
  -0.056  -0.048  -0.040  -0.031  -0.021  -0.012  -0.005   0.000
   2.778                    3.64                                26
   0.000   0.005   0.008   0.013   0.026   0.051   0.077   0.102   0.153
   0.205   0.256   0.307   0.358   0.409   0.460   0.512   0.563   0.614
   0.665   0.716   0.767   0.818   0.870   0.921   0.972   1.023
   0.000   0.012   0.015   0.018   0.025   0.035   0.042   0.049   0.058
   0.065   0.071   0.074   0.076   0.077   0.075   0.072   0.067   0.062
   0.056   0.048   0.040   0.031   0.021   0.012   0.005   0.000
   0.000  -0.012  -0.015  -0.018  -0.025  -0.035  -0.042  -0.049  -0.058
  -0.065  -0.071  -0.074  -0.076  -0.077  -0.075  -0.072  -0.067  -0.062
  -0.056  -0.048  -0.040  -0.031  -0.021  -0.012  -0.005   0.000
   6.389                   25.53                                26
   0.000   0.018   0.027   0.046   0.091   0.183   0.274   0.365   0.548
   0.730   0.913   1.095   1.278   1.460   1.643   1.825   2.008   2.190
   2.372   2.555   2.738   2.920   3.103   3.285   3.467   3.650
   0.000   0.044   0.052   0.066   0.090   0.125   0.151   0.173   0.207
   0.233   0.252   0.265   0.272   0.274   0.267   0.256   0.240   0.221
```

Listing of *airfoil.bank* file (Continued)

0.199	0.173	0.143	0.110	0.076	0.044	0.016	0.000	
0.000	-0.044	-0.052	-0.066	-0.090	-0.125	-0.151	-0.173	-0.207
-0.233	-0.252	-0.265	-0.272	-0.274	-0.267	-0.256	-0.240	-0.221
-0.199	-0.173	-0.143	-0.110	-0.076	-0.044	-0.016	0.000	
10.447			36.44				26	
0.000	0.017	0.025	0.042	0.084	0.168	0.251	0.335	0.502
0.670	0.837	1.005	1.172	1.340	1.507	1.675	1.842	2.010
2.177	2.345	2.512	2.680	2.848	3.015	3.182	3.350	
0.000	0.040	0.048	0.060	0.082	0.115	0.139	0.159	0.190
0.214	0.231	0.243	0.250	0.251	0.245	0.235	0.221	0.203
0.183	0.159	0.131	0.101	0.070	0.040	0.015	0.000	
0.000	-0.040	-0.048	-0.060	-0.082	-0.115	-0.139	-0.159	-0.190
-0.214	-0.231	-0.243	-0.250	-0.251	-0.245	-0.235	-0.221	-0.203
-0.183	-0.159	-0.131	-0.101	-0.070	-0.040	-0.015	0.000	
12.250			40.10				26	
0.000	0.006	0.009	0.015	0.031	0.062	0.092	0.123	0.185
0.246	0.308	0.369	0.431	0.492	0.553	0.615	0.677	0.738
0.799	0.861	0.923	0.984	1.046	1.107	1.168	1.230	
0.000	0.015	0.018	0.022	0.030	0.042	0.051	0.058	0.070
0.079	0.085	0.089	0.092	0.092	0.090	0.086	0.081	0.075
0.067	0.058	0.048	0.037	0.026	0.015	0.005	0.000	
0.000	-0.015	-0.018	-0.022	-0.030	-0.042	-0.051	-0.058	-0.070
-0.079	-0.085	-0.089	-0.092	-0.092	-0.090	-0.086	-0.081	-0.075
-0.067	-0.058	-0.048	-0.037	-0.026	-0.015	-0.005	0.00	

APPENDIX C

T/BEST NEUTRAL FILE INPUT & OUTPUT

In this appendix, the sources used to obtain all parameters of the neutral file are identified. These parameters fall under three categories:

1. neutral file input parameters
2. neutral file output parameters
3. neutral file defaulted parameters

All the neutral file data obtained from a module or given to a module are listed. A module can use neutral file parameters as input. Also, that same module can provide some neutral file parameters through its output. The T/BEST modules NNEPWATE, BLASIM, MTSB, and FLOPS do not supply the neutral file directly with any data. The input generators of these modules use data from neutral file to generate the required input files. Once these modules are executed, the post-processors are used to update the neutral file for the selected parameters. Note that the graphic modules, bchart and pchart, read the neutral file to display selected results.

C.1 NEUTGEN Module: permits the update of any defaulted parameter

The execution of this module sets the foundation for generating the neutral file. A block of data is initialized at this stage beginning with the parameter ALT to the end of the neutral file. Some of these parameters are updated during the course of executing T/BEST. This block of data is written to a file named *neutral.add* and stored in the user's input directory. Also, depending on the user's level of expertise, beginner, or intermediate, or expert, parameters in the neutral file may be assigned new values.

The *neutral.add* file will be generated only if it does not exist during the execution of T/BEST. It will give the user the opportunity to edit this file and modify any defaulted parameters. This procedure of modifying defaulted parameters can be used as an alternate method to the one mentioned in the previous paragraph.

Listing of the *neutral.add* file

CRUISE ALTITUDE	ALT	0.60000E+05	(ft.)
CRUISE SPEED	VC	0.24000E+01	(MACH NO.)
CRUISE SPECIFIC FUEL CONSUP	SFCC	0.12050E+01	(LB/LBT/HR)
CRUISE THRUST	ATC	0.16285E+05	(LBST)
RANGE	RANGE	0.50000E+04	(MILES)
BREGUET RANGE	BRANGE	0.70997E+04	(MILES)
TIME TO CLIMB	TC	0.50000E+00	(HOURS)
TIME TO DECEND	TD	0.50000E+00	(HOURS)
DAY NITE FACTOR	DNF	0.12500E+01	
SPARE PARTS FACTOR	SPF	0.15000E+01	
CAPTAIN'S PAY	ODPP	0.50000E+00	($/HOUR)
COPILOT'S PAY	ODPCP	0.25000E+00	($/HOUR)
FLIGHT'S ENGINEER PAY	ODPFE	0.25000E+00	($/HOUR)
GROSS NAT. PROD. DEF. RAT.	GNPDR	4.08122E+00	
DOMESTIC TRAVEL FACTOR	ED	0.18000E+01	($/HOUR)
INTERNATIONAL TAVEL FACTOR	EI	0.28000E+01	($/HOUR)
TRAINING FACTOR	KT	0.40000E-01	
VACATION FACTOR	KV	0.50000E-01	
CREW PREMIUM FACTOR	KP	0.50000E-01	
PAYROLL TAX FACTOR	KI	0.12000E+00	
ANNUAL FLIGHT HOURS (U.S.A)	AHD	0.80000E+03	(HOURS)
ANNUAL FLIGHT HOURS (INT.)	AHI	0.75000E+03	(HOURS)
CAPTAIN'S BASE PAY	BPP	0.36000E+04	($/YEAR)
1ST OFFICER'S BASE PAY	BPCP	0.32000E+04	($/YEAR)
FLIGHT ENGINEER'S BASE PAY	BPFE	0.34000E+04	($/YEAR)
FUEL COST (USA)	AFUELD	0.11000E+00	($/GAL)
FUEL COST (INTERNATIONAL)	AFUELI	0.14000E+00	($/GAL)
JET OIL COST (US)	BOILTD	0.60000E+01	($/GAL)
JET OIL COST (INT.)	BOILTI	0.60000E+01	($/GAL)
ENGINE OIL (US)	BOILRD	0.41000E+00	($/GAL)
ENGINE OIL (INT.)	BOILRI	0.62000E+00	($/GAL)
FUEL CONSUMED AT CRUISE	FCR	0.00000E+00	(LBS)
FUEL USED IN CLIMB	FCL	0.15659E+05	(LBS)
FUEL USED IN DESCENT	FD	0.15659E+05	(LBS)
FUEL FOR GROUND MANEUVERS	FGM	0.15659E+05	(LBS)
DISTANCE FOR CLIMB	DC	0.57799E+03	(MILES)
DISTANCE DESCENT	DD	0.57799E+03	(MILES)
MANEUVERING DISTANCE	DAM	0.28899E+02	(MILES)
GROUND SPEED	VG	0.26784E+04	(MPH)
COST OF COMPLETE AIRPLANE	CT	0.12916E+08	($)
COST OF AIRPLANE LESS ENG.	CSPA	0.10819E+08	($)
COST OF AIR. LESS ENG,PROP	CA	0.10819E+08	($)
COST OF ONE ENGINE	CE	0.52426E+06	($)
COST OF ONE PROP	CP	0.52426E+05	($)
NUMBER OF PROPS	ANP	0.00000E+00	
TIME BETWEEN ENG. OVERHAULS	HEO	0.11000E+04	(HOURS)
TAKEOFF EQUIV. HORSE POWER	ESHP	0.00000E+00	(LBS)
DENSITY OF FUEL	WF	0.65000E+01	(LBS/GAL)
DENSITY OF OIL	WO	0.81000E+01	(LBS/GAL)
INSURANCE RATE DOLLAR/VALUE	AIRA	0.40000E-01	(%/YR,eg .04)
INSURANCE: LIABILITY&DAMAGE	PLPD	0.87000E-03	($/MILE)
LABOR COST	RL	0.30000E+01	($/HOUR)
AIRPLANE DEPRECIAT. FACTOR	AKDA	0.85000E+00	
ENGINE DEPRECIATION FACTOR	AKDE	0.85000E+00	
PROP DEPRECIATION FACTOR	AKDP	0.85000E+00	
SPARE AIRPLANE DEPRECIATION	AKDSA	0.85000E+00	
SPARE ENGINE DEPRECIATION	AKDSE	0.85000E+00	
AIRFRAME DEPRECIATION	DA	0.10000E+02	(YEARS)
ENGINE DEPRECIATION	DE	0.70000E+01	(YEARS)

Listing of the *neutral.add* file (Continued)

PROP DEPRECIATION	DP	0.70000E+01	(YEARS)
SPARE AIRFRAME DEPRECIATION	DAS	0.10000E+02	(YEARS)
SPARE ENGINE DEPRECIATION	DES	0.10000E+02	(YEARS)
AIRPLANE SPARES/AIR. PRICE	AKSPA	0.10000E+00	
ENGINE SPARES/ENGINE PRICE	AKSPE	0.50000E+00	
BLOCK FUEL	FB	0.15659E+06	(LBS)
CAPTAIN GROSS WEIGHT FACTOR	GWFP	0.59748E+01	($/HR)
1ST OF. GROSS WEIGHT FACTOR	GWFCP	0.29029E+01	($/HR)
FLT. ENG. GROSS WT. FACTOR	GWFFE	0.30832E+01	($/HR)
CAPTAIN MILEAGE RATE FACTOR	XMRFP	0.30573E+02	($/HR)
1ST OF. MILEAGE RATE FACTOR	XMRCP	0.16027E+02	($/HR)
FLT ENG MILEAGE RATE FACTOR	XMRFE	0.14731E+02	($/HR)
TIME TO CRUISE DOMESTIC	TGD	0.18666E+01	(HOURS)
GROUND MANUEVERING TIME	TGM	0.42945E+00	(HOURS)
DOMESTIC BLOCK TIME	TBD	0.32961E+01	(HOURS)
DOMESTIC BLOCK SPEED	VBD	0.17536E+04	(MPH)
DOM. TURBINE AIRCRAFT UTIL.	UTD	0.32583E+04	(HRS/YEAR)
DOM. RECP. ENG. AIR. UTIL.	URD	0.35759E+04	(HRS/YEAR)
INTERNATIONAL BLOCK SPEED	VBI	0.18129E+04	(MPH)
INTERNATIONAL BLOCK TIME	TBI	0.31882E+01	(HOURS)
TIME TO CRUISE INTERNAT.	TGI	0.17587E+01	(HOURS)
INT TURBINE AIR. UTILIZAION	UTI	0.32503E+04	(HRS/YEAR)
INT RECP. ENG. AIR. UTIL.	URI	0.35636E+04	(HRS/YEAR)
CAPTAINS DOMESTIC COST	CAMPD	0.30880E-01	($/MILE)
1S OFFICERS DOMESTIC COST	CAMCPD	0.17682E-01	($/MILE)
FLIGHT ENG. DOMESTIC COST	CAMFED	0.28443E-01	($/MILE)
DOMESTIC FUEL COST	CFTD	0.47224E+00	($/MILE)
DOMESTIC OIL COST	COTD	0.11661E-02	($/MILE)
DOMESTIC INSURANCE COSTS	CINTD	0.91290E-01	($/MILE)
DOM TURB AIRFR LABOR COST	ALBTD	0.34604E-01	($/MILE)
DOM TURB AIRFR BURDEN COST	ALBTDMB	0.30797E-01	($/MILE)
DOM REC ENG AIR LABOR COST	ALBRD	0.32313E-01	($/MILE)
DOM REC ENG BURDEN COST	ALBRDMB	0.28758E-01	($/MILE)
DOM TURB ENG LABOR MAINT.	ELBTD	0.94044E-02	($/MILE)
DOM TURB ENG BURDEN COST	ELBTDMB	0.83699E-02	($/MILE)
DOM TURBPROP ENG LABOR MAIN	ELBPD	0.69786E-02	($/MILE)
DOM TURBPROP ENG BURDEN	ELBPDMB	0.62109E-02	($/MILE)
DOM REC ENG. LABOR MAINT.	ELBRD	0.37265E-01	($/MILE)
DOM REC ENG MAINT BURDEN	ELBRDMB	0.33166E-01	($/MILE)
DOM TURB ENG AIR MAINT MATE	CMATD	0.51669E-01	($/MILE)
DOM TURB ENG AIR MAINT BURD	CMATDMB	0.12039E-01	($/MILE)
DOM REC ENG AIR MAINT MATE	CMARD	0.31946E-01	($/MILE)
DOM REC ENG AIR MAINT BURD	CMARDMB	0.74435E-02	($/MILE)
DOM TURB ENG MAINT MATERIAL	CMETD	0.99222E-01	($/MILE)
DOM TURB ENG MAINT BURDEN	CMETDMB	0.23119E-01	($/MILE)
DOM REC ENG MAINT MATERIALS	CMERD	0.37778E+00	($/MILE)
DOM REC ENG MAINT BURDEN	CMERDMB	0.88022E-01	($/MILE)
DOM TURB AIR APP MAINT BURD	CMBTD	0.74325E-01	($/MILE)
DOM REC ENG AIR APP BURDEN	CMBRD	0.15739E+00	($/MILE)
DOM TURBPROP AIR. APP. BURD	CMBPD	0.72166E-01	($/MILE)
DOM TURB AIR DEPRECIATION	CDATD	0.16094E+00	($/MILE)
DOM REC ENG AIRCRAFT DEPREC	CDARD	0.14665E+00	($/MILE)
DOM TURB ENG DEPRECIATION	CDETD	0.44567E-01	($/MILE)
DOM. REC. ENG DEPRECIATION	CDERD	0.40609E-01	($/MILE)
DOM SPARE TURB AIR. DEPRECI	DSATD	0.16094E-01	($/MILE)
DOM SPARE REC ENG AIR DEPRE	DSARD	0.14665E-01	($/MILE)
DOM. SPARE TURB ENG DEPRECI	DSETD	0.33426E-01	($/MILE)

Listing of the *neutral.add* file (Continued)

DOM. SPARE REC. ENG DEPRECI	DSERD	0.30457E-01	($/MILE)
DOM. SPARE PROP DEPRECIATIO	CDPD	0.00000E+00	($/MILE)
INTERNATIONAL FUEL COSTS	CFTI	0.60103E+00	($/MILE)
INTERNATIONAL OIL COSTS	COTI	0.11279E-02	($/MILE)
INTERNATIONAL INSURANCE	CINTI	0.88545E-01	($/MILE)
INT. TURB AIRFRAME LABOR	ALBTI	0.33471E-01	($/MILE)
INT. REC. ENG. AIR LABOR	ALBRI	0.31255E-01	($/MILE)
INT. TURB ENG LABOR MAINTE	ELBTI	0.90965E-02	($/MILE)
INT TURBPROP ENG. LABOR MAI	ELBPI	0.67501E-02	($/MILE)
INT REC ENG LABOR MAINTENAN	ELBRI	0.36045E-01	($/MILE)
INT TURB ENG AIR MAIN MATER	CMATI	0.49978E-01	($/MILE)
INT REC ENG AIR MAINT MATER	CMARI	0.30901E-01	($/MILE)
INT TURB ENG MAINT MATERIAL	CMETI	0.95974E-01	($/MILE)
INT REC ENG MAINT MATERIALS	CMERI	0.36541E+00	($/MILE)
INT TURB AIR APP MAINT BURD	CMBTD	0.74325E-01	($/MILE)
INT REC ENG AIR APP BURD	CMBRD	0.15739E+00	($/MILE)
INT. TURBOPROP AIR APP BURD	CMBPD	0.72166E-01	($/MILE)
INT. TURB AIR DEPRECIATION	CDATI	0.15606E+00	($/MILE)
INT REC ENG AIR DEPRECIATIO	CDARI	0.14234E+00	($/MILE)
INT TURB ENG DEPRECIATION	CDETI	0.43215E-01	($/MILE)
INT. REC. ENG DEPRECIATION	CDERI	0.39415E-01	($/MILE)
INT. SPARE TURB. AIR DEPREC	DSATI	0.15606E-01	($/MILE)
INT SPARE REC ENG AIR DEPR	DSARI	0.14234E-01	($/MILE)
INT. SPARE TURB ENG DEPRECI	DSETI	0.32411E-01	($/MILE)
INT. SPARE REC. ENG DEPRECI	DSERI	0.29561E-01	($/MILE)
INT. SPARE PROP DEPRECIATIO	CDPI	0.00000E+00	($/MILE)
U. S. CITY PAIRS	USCITY	0.21550E+04	
WESTERN EUROPE CITY PAIRS	INTCITY	0.44910E+04	
NEW JET/FAN MAIN. COST 1YR	NEWT1	0.31526E+00	($/MILE)
DERIVATIVE JET/FAN ENG 1YR	DERT1	0.35029E-01	($/MILE)
NEW JET/FAN MAIN. COST 2YR	NEWT2	0.45537E+00	($/MILE)
DERIVATIVE JET/FAN ENG 2YR	DERT2	0.70058E-01	($/MILE)
NEW JET/FAN MAIN. COST 3YR	NEWT3	0.38532E+00	($/MILE)
DERIVATIVE JET/FAN ENG 3YR	DERT3	0.10509E+00	($/MILE)
NEW JET/FAN MAIN. COST 4YR	NEWT4	0.31526E+00	($/MILE)
DERIVATIVE.JET/FAN ENG 4YR	DERT4	0.12260E+00	($/MILE)
NEW JET/FAN MAIN. COST 5YR	NEWT5	0.24520E+00	($/MILE)
DERIVATIVE JET/FAN ENG 5YR	DERT5	0.13136E+00	($/MILE)
NEW JET/FAN MAIN. COST 6YR	NEWT6	0.21017E+00	($/MILE)
DERIVATIVE JET/FAN ENG 6YR	DERT6	0.14012E+00	($/MILE)
NEW JET/FAN MAIN. COST 7YR	NEWT7	0.17514E+00	($/MILE)
DERIVATIVE JET/FAN ENG 7YR	DERT7	0.14362E+00	($/MILE)
NEW JET/FAN MAIN. COST 8YR	NEWT8	0.15763E+00	($/MILE)
DERIVATIVE JET/FAN ENG 8YR	DERT8	0.14362E+00	($/MILE)
NEW JET/FAN MAIN. COST 9YR	NEWT9	0.14012E+00	($/MILE)
DERIVATIVE JET/FAN ENG 9YR	DERT9	0.14012E+00	($/MILE)
NEW JET/FAN MAIN. COST 10YR	NEWT10	0.13661E+00	($/MILE)
DERIVATIVE JET/FAN ENG 10YR	DERT10	0.13661E+00	($/MILE)
NEW JET/FAN MAIN. COST 11YR	NEWT11	0.13311E+00	($/MILE)
DERIVATIVE JET/FAN ENG 11YR	DERT11	0.13311E+00	($/MILE)
NEW JET/FAN MAIN. COST 12YR	NEWT12	0.13136E+00	($/MILE)
DERIVATIVE JET/FAN ENG 12YR	DERT12	0.13136E+00	($/MILE)
NEW JET/FAN 8YR TOTAL	NEWTJET	0.36444E+07	($)
DERIVATIVE JET/FAN 8YR TOTA	DERTJET	0.14380E+07	($)
NEW TURPROP MAIN. COST 1YR	NEWP1	0.30494E+00	($/MILE)
DERIVATIVE JET/FAN ENG 1YR	DERP1	0.33883E-01	($/MILE)
NEW TURPROP MAIN. COST 2YR	NEWP2	0.44047E+00	($/MILE)
DERIVATIVE JET/FAN ENG 2YR	DERP2	0.67765E-01	($/MILE)
NEW TURPROP MAIN. COST 3YR	NEWP3	0.37271E+00	($/MILE)

Listing of the *neutral.add* file (Continued)

DERIVATIVE JET/FAN ENG 3YR	DERP3	0.10165E+00	($/MILE)	
NEW TURPROP MAIN. COST 4YR	NEWP4	0.30494E+00	($/MILE)	
DERIVATIVE JET/FAN ENG 4YR	DERP4	0.11859E+00	($/MILE)	
NEW TURPROP MAIN. COST 5YR	NEWP5	0.23718E+00	($/MILE)	
DERIVATIVE JET/FAN ENG 5YR	DERP5	0.12706E+00	($/MILE)	
NEW TURPROP MAIN. COST 6YR	NEWP6	0.20330E+00	($/MILE)	
DERIVATIVE JET/FAN ENG 6YR	DERP6	0.13553E+00	($/MILE)	
NEW TURPROP MAIN. COST 7YR	NEWP7	0.16941E+00	($/MILE)	
DERIVATIVE JET/FAN ENG 7YR	DERP7	0.13892E+00	($/MILE)	
NEW TURPROP MAIN. COST 8YR	NEWP8	0.15247E+00	($/MILE)	
DERIVATIVE JET/FAN ENG 8YR	DERP8	0.13892E+00	($/MILE)	
NEW TURPROP MAIN. COST 9YR	NEWP9	0.13553E+00	($/MILE)	
DERIVATIVE JET/FAN ENG 9YR	DERP9	0.13553E+00	($/MILE)	
NEW TURPROP MAIN. COST 10YR	NEWP10	0.13214E+00	($/MILE)	
DERIVATIVE JET/FAN ENG 10YR	DERP10	0.13214E+00	($/MILE)	
NEW TURPROP MAIN. COST 11YR	NEWP11	0.12875E+00	($/MILE)	
DERIVATIVE JET/FAN ENG 11YR	DERP11	0.12875E+00	($/MILE)	
NEW TURPROP MAIN. COST 12YR	NEWP12	0.12706E+00	($/MILE)	
DERIVATIVE JET/FAN ENG 12YR	DERP12	0.12706E+00	($/MILE)	
NEW RECIENG 8YR TOTAL	NEWPJET	0.35252E+07	($)	
DERIVATIVE RECIENG 8YR TOTA	DERPJET	0.13909E+07	($)	
NEW RECIENG MAIN. COST 1YR	NEWR1	0.12065E+01	($/MILE)	
DERIVATIVE RECIENG ENG 1YR	DERR1	0.13406E+00	($/MILE)	
NEW RECIENG MAIN. COST 2YR	NEWR2	0.17428E+01	($/MILE)	
DERIVATIVE RECIENG ENG 2YR	DERR2	0.26812E+00	($/MILE)	
NEW RECIENG MAIN. COST 3YR	NEWR3	0.14746E+01	($/MILE)	
DERIVATIVE RECIENG ENG 3YR	DERR3	0.40217E+00	($/MILE)	
NEW RECIENG MAIN. COST 4YR	NEWR4	0.12065E+01	($/MILE)	
DERIVATIVE RECIENG ENG 4YR	DERR4	0.46920E+00	($/MILE)	
NEW RECIENG MAIN. COST 5YR	NEWR5	0.93841E+00	($/MILE)	
DERIVATIVE RECIENG ENG 5YR	DERR5	0.50272E+00	($/MILE)	
NEW RECIENG MAIN. COST 6YR	NEWR6	0.80435E+00	($/MILE)	
DERIVATIVE RECIENG ENG 6YR	DERR6	0.53623E+00	($/MILE)	
NEW RECIENG MAIN. COST 7YR	NEWR7	0.67029E+00	($/MILE)	
DERIVATIVE RECIENG ENG 7YR	DERR7	0.54964E+00	($/MILE)	
NEW RECIENG MAIN. COST 8YR	NEWR8	0.60326E+00	($/MILE)	
DERIVATIVE RECIENG ENG 8YR	DERR8	0.54964E+00	($/MILE)	
NEW RECIENG MAIN. COST 9YR	NEWR9	0.53623E+00	($/MILE)	
DERIVATIVE RECIENG ENG 9YR	DERR9	0.53623E+00	($/MILE)	
NEW RECIENG MAIN. COST 10YR	NEWR10	0.52283E+00	($/MILE)	
DERIVATIVE RECIENG ENG 10YR	DERR10	0.52283E+00	($/MILE)	
NEW RECIENG MAIN. COST 11YR	NEWR11	0.50942E+00	($/MILE)	
DERIVATIVE RECIENG ENG 11YR	DERR11	0.50942E+00	($/MILE)	
NEW RECIENG MAIN. COST 12YR	NEWR12	0.50272E+00	($/MILE)	
DERIVATIVE RECIENG ENG 12YR	DERR12	0.50272E+00	($/MILE)	
NEW RECIENG 8YR TOTAL	NEWRENG	0.13948E+08	($)	
DERIVATIVE RECIENG 8YR TOTA	DERRENG	0.55034E+07	($)	
LOW PRESSURE COMPRESS PRICE	LCPRICE	0.00000E+00	($)	
HIGH PRESSURE COMPRES PRICE	HCPRICE	0.00000E+00	($)	
INLET PRICE	INPRICE	0.00000E+00	($)	(NOT ACTUAL)
DUCT PRICE	DUPRICE	0.00000E+00	($)	(NOT ACTUAL)
BURNER PRICE	BUPRICE	0.00000E+00	($)	(NOT ACTUAL)
AUGMENTER PRICE	AUPRICE	0.00000E+00	($)	(NOT ACTUAL)
MIXER PRICE	FMPRICE	0.00000E+00	($)	(NOT ACTUAL)
NOZZLE PRICE	NOPRICE	0.00000E+00	($)	(NOT ACTUAL)

Listing of the *neutral.add* file (Continued)

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  SHAFT PRICE                    SHPRICE     0.00000E+00   ($)     (NOT ACTUAL)
  DIFFUSER PRICE                 DIFPRICE    0.00000E+00   ($)
  COMBUSTOR PRICE                CBPRICE     0.00000E+00   ($)
  HIGH PRESSURE TURBINE PRICE    HTPRICE     0.00000E+00   ($)
  LOW  PRESSURE TURBINE PRICE    LTPRICE     0.00000E+00   ($)
  LOW PRESSURE COMPRESS MTBR     LCMTBR      0.00000E+00   (HR)
  HIGH PRESSURE COMPRES MTBR     HCMTBR      0.00000E+00   (HR)
  INLET MEAN TIME REPAIR         INMTBR      0.00000E+00   (HR)
  DUCT MEAN TIME  REPAIR         DUMTBR      0.00000E+00   (HR)
  BURNER MEAN TIME REPAIR        BUMTBR      0.00000E+00   (HR)
  AUGMENTER MEAN TIME REPAIR     AUMTBR      0.00000E+00   (HR)
  MIXER MEAN TIME REPAIR         FMMTBR      0.00000E+00   (HR)
  NOZZLE MEAN TIME REPAIR        NOMTBR      0.00000E+00   (HR)
  SHAFT MEAN TIME REPAIR         SHMTBR      0.00000E+00   (HR)
  DIFFUSER MTBR                  DIFMTBR     0.00000E+00   (HR)
  COMBUSTOR MTBR                 CBMTBR      0.00000E+00   (HR)
  HIGH PRESSURE TURBINE MTBR     HTMTBR      0.00000E+00   (HR)
  LOW  PRESSURE TURBINE MTBR     LTMTBR      0.00000E+00   (HR)
  LOW PRESSURE COMPRESS LABOR    LCHOURS     0.00000E+00   (HR)
  HIGH PRESSURE COMPRES LABOR    HCHOURS     0.00000E+00   (HR)
  INLET LABOR                    INHOURS     0.00000E+00   (HR)
  DUCT LABOR                     DUHOURS     0.00000E+00   (HR)
  BURNER LABOR                   BUHOURS     0.00000E+00   (HR)
  AUGMENTER LABOR                AUHOURS     0.00000E+00   (HR)
  MIXER LABOR                    FMHOURS     0.00000E+00   (HR)
  NOZZLE LABOR                   NOHOURS     0.00000E+00   (HR)
  SHAFT LABOR                    SHHOURS     0.00000E+00   (HR)
  DIFFUSER LABOR                 DIFHOURS    0.00000E+00   (HR)
  COMBUSTOR LABOR                CBHOURS     0.00000E+00   (HR)
  HIGH PRESSURE TURBINE LABOR    HTHOURS     0.00000E+00   (HR)
  LOW  PRESSURE TURBINE LABOR    LTHOURS     0.00000E+00   (HR)
  LPC MATERIALS COST             LCCOST      0.00000E+00   ($)
  HPC MATERIALS COST             HCCOST      0.00000E+00   ($)
  INLET MATERIALS COST           INCOST      0.00000E+00   ($)     (NOT ACTUAL)
  DUCT MATERIALS COST            DUCOST      0.00000E+00   ($)     (NOT ACTUAL)
  BURNER MATERIALS COST          BUCOST      0.00000E+00   ($)     (NOT ACTUAL)
  AUGMENTER MATERIALS COST       AUCOST      0.00000E+00   ($)     (NOT ACTUAL)
  MIXER MATERIALS COST           FMCOST      0.00000E+00   ($)     (NOT ACTUAL)
  NOZZLE MATERIALS COST          NOCOST      0.00000E+00   ($)     (NOT ACTUAL)
  SHAFT MATERIALS COST           SHCOST      0.00000E+00   ($)     (NOT ACTUAL)
  DIFFUSER MATERIALS COST        DIFCOST     0.00000E+00   ($)
  COMBUSTOR MATERIALS COS        CBCOST      0.00000E+00   ($)
  HPT MATERIALS COST             HTCOST      0.00000E+00   ($)
  LPT MATERIALS COST             LTCOST      0.00000E+00   ($)
 BEGIN FLOPS DATA
FLOPS PROGRAM CONTROL
  FLOPS PROBLEM TYPE             IOPT             1
  FLOPS ANALYSIS OPTION          IANAL            3
  FLOPS COST ANALYSIS FLAG       ICOST            1
FLOPS GEOMETRIC, WEIGHT, BALANCE AND INERTIA DATA
  STRUCTURAL ULTIMATE LOAD       ULF         0.42200E+01   (FACTOR)
FLOPS WING DATA
  DIHEDRAL (POSITIVE)            DIH         0.70000E+00   (deg.)
FLOPS HORIZONTAL TAIL DATA
 AREA                            SHT         0.38881E+03   (ft^2)
  1/4 CHORD SWEEP ANGLE          SWPHT       0.35000E+02   (deg.)
  ASPECT RATIO                   ARHT        0.40000E+01
  TAPER RATIO                    TRHT        0.40000E+00
  T/C                            TCHT        0.11000E+00
  LOCATION ON VERTICAL TAIL      HHT         0.10000E+01
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Listing of the *neutral.add* file (Continued)

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 FLOPS VERTICAL TAIL DATA
  NUMBER OF VERTICAL TAILS     NVERT        1
  AREA                         SVT        0.39387E+03   (ft^2)
  1/4 CHORD SWEEP ANGLE        SWPVT      0.55000E+02   (deg.)
  ASPECT RATIO                 ARVT       0.67000E+00
  TAPER RATIO                  TRVT       0.70000E+00
  T/C                          TCVT       0.12000E+00
FLOPS FUSELAGE DATA
  NUMBER OF FUSELAGES          NFUSE        1
  TOTAL LENGTH                 XL         0.15235E+03   (ft)
  MAXIMUM WIDTH                WF         0.16440E+02   (ft)
  MAXIMUM DEPTH                DF         0.17000E+02   (ft)
  CARGO AIRCRAFT FACTOR        CARGF      0.00000E+00
  PASSENGER COMPART LENGTH     XLP        0.00000E+00   (ft)
FLOPS LANDING GEAR DATA
  LENGTH OF MAIN GEAR          XMLG       0.00000E+00   (in)
  LENGTH OF NOSE GEAR          XNLG       0.00000E+00   (in)
  CARRIER BASED AIRCRAFT       CARBAS     0.00000E+00
FLOPS PROPULSION SYSTEM DATA
  NUMBER OF ENGINES ON WING    NEW          4
  NUMBER OF ENGINES ON FUSE    NEF          0
  BASELINE ENGINE THRUST       THRSO      0.50000E+05   (lbf)
  BASELINE ENGINE WEIGHT       WENG       0.15491E+05   (lbf)
  WEIGHT SCALING PARAMETER     EEXP       0.11500E+01
  BASELINE NACELLE LENGTH      XNAC       0.17920E+02   (ft)
  BASELINE NACELLE DIAMETER    DNAC       0.12550E+02   (ft)
  FUEL CAPACITY OF WING        FULWMX    -0.10000E+01   (lbm)
  FUEL CAPACITY OF FUSELAGE    FULFMX     0.00000E+00   (lbm)
  AUX. TANK FUEL CAPACITY      FULAUX     0.00000E+00   (lbm)
  NUMBER OF FUEL TANKS         NTANK       10
  ADDED MISC PROP SYSTEM WT    WPMISC     0.00000E+00   (lbf)
FLOPS CREW AND PAYLOAD DATA
  FIRST CLASS PASSENGERS       NPF         20
  TOURIST PASSENGERS           NPT        180
  STEWARDESSES                 NSTU         5
  GALLEY CREW                  NGALC        0
  FLIGHT CREW                  NFLCR        3
  WEIGHT PER PASSENGER         WPPASS     0.16500E+03   (lbf)
  BAGGAGE PER PASSENGER        BPP        0.40000E+02   (lbf)
FLOPS OVERRIDE PARAMETERS FOR WEIGHTS (ALL SET TO TO 1.0 EXCEPT WTHR)
  THRUST REVERSERS - TOTAL     WTHR       0.36100E+04
FLOPS CONFINGURATION GEOMETRIC RATIOS, OBJ. FUNCTION, DESIGN VARIABLES
  DESIGN RANGE                 DESRNG     0.50000E+04   (n.mi)
  WING LOADING REQUIRED        WSR        0.11000E+03
  THRUST/WEIGHT REQUIRED       TWR        0.50000E+00
  HORIZ TAIL VOLUME COEF       HTVC       0.10000E+01
  VERT TAIL VOLUME COEF        VTVC       0.10000E+01
  RAMP WEIGHT                  GWFLOPS    0.70000E+06   (lbf)
  WING ASPECT RATIO            ARFLOPS    0.50000E+01
 WING TAPER RATIO              TRFLOPS    0.08000E+00
  WING 1/4 CHORD SWEEP         SWEEP      0.31500E+02   (deg.)
  WING THICKNESS-CHORD RATIO   TCA        0.06000E+00
  CRUISE MACH NUMBER           VCMN       0.80000E+00
  MAX CRUISE ALTITUDE          CH         0.40000E+05   (ft)
  OBJ. FUN. WEIGHTING FACTOR   OFG        0.00000E+00   (GROSS WEIGHT)
  OBJ. FUN. WEIGHTING FACTOR   OFF        0.00000E+00   (MISSION FUEL)
  OBJ. FUN. WEIGHTING FACTOR   OFC        0.00000E+00   (COST)
FLOPS AERODYNAMIC OPTIONS AND APPROXIMATE TAKEOFF AND LANDING DATA
  WING TECHNOLOGY              AITEK      0.15000E+01
  FIXED DESIGN LIFT COEFFIC.   FCLDES    -0.10000E+01
  TURBULENT/LAMINAR FLOW       XLLAM      0.00000E+00   (1.0 FOR LAMINAR)
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Listing of the *neutral.add* file (Continued)

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FLOPS TAKEOFF AND LANDING DATA
  MAX. LANDING/TAKEOFF WEIGHT WRATIO     0.81250E+00
  MAX. LANDING VELOCITY       VAPPR      0.15000E+03   (kts)
  MAX. TAKEOFF FIELD LENGTH   FLTO       0.70000E+04   (ft)
  MAX. LANDING FIELD LENGTH   FLLDG      0.70000E+04   (ft)
  MAX. CL TAKEOFF CONFIG.     CLTOM      0.20000E+01
  MAX. CL LANDING CONFIG.     CLLDM      0.30000E+01
  AIR DENSITY RATIO           DRATIO     0.10000E+01
FLOPS ENGINE DECK CONTROL, SCALING AND USAGE DATA
  FLIGHT IDLE SWITCH          IDLE          1
  INDICATOR OF ENGINE DECK    IGENEN       -1          (-1 FOR EXTERNAL)
  MIN IDLE FUEL FLOW FRACT    FIDMIN     0.80000E-01
  MAX IDLE FUEL FLOW FRACT    FIDMAX     0.10000E+01
  ENGINE DECK FILE NAME       EIFILE    nnepwate.missout
FLOPS PERFORMANCE CONTROLS AND FACTORS AND MISSION SEGMENT DEFINITION
  PRINT MISSION CONTROL       IFLAG         1
  DETAILED MISSION PRINT      MSUMPT        1
  FLAG FOR RAMP WEIGHT ESTIM. IRW           1
  FUEL FLOW FACTOR            FACT       0.90000E+00
  CDO FACTOR                  FCDO       0.10000E+01
  CDI FACTOR                  FCDI       0.10000E+01
  OWE FACTOR                  OWFACT     0.10000E+01
  RANGE TOLERANCE             RTOL       0.10000E+00   (n.mi)
  ATA TRAFFIC ALLOWANCE       IATA          1
  WEIGHT INCREMENT            DWT        0.10000E+01   (lbf)
FLOPS GROUND OPERATIONS AND TAKEOFF INPUT
  TAKEOFF TIME                TAKOTM     0.40000E+00   (min)
  TAXI-OUT TIME               TAXOTM     0.10000E+02   (min)
  TAXI-IN TIME                TAXITM     0.10000E+02   (min)
  TAKEOFF POWER SETTING       ITTFF         1
FLOPS INPUT FOR 1 CLIMB SCHEDULES
  MINIMUM CLIMB MACH NUMBER   CLMMIN     0.30000E+00
  MINIMUM CLIMB ALTITUDE      CLAMIN     0.00000E+00   (ft)
  NUMBER OF CLIMB STEPS       NINCL        15
  CLIMB OPTIMIZATION FACTOR   FWF       -0.10000E+01
FLOPS INPUT FOR 1 CRUISE SCHEDULES
  CRUISE OPTION SWITCH        IOC           1
  MINIMUM MACH NUMBER         CRMMIN     0.70000E+00
FLOPS INPUT FOR DESCENT SCHEDULE
  MINIMUM DESCENT ALTITUDE    DEAMIN     0.00000E+00   (ft)
FLOPS RESERVE SEGMENT INPUT
  MISSED APPROACH TIME        TIMMAP     0.50000E+01   (min)
  RESERVE HOLDING TIME        HOLDTM     0.30000E+02   (min)
  2ND RES HOLD TIME OR FRAC   THOLD      0.50000E-01   (min)
FLOPS INPUT FOR DESCENT SCHEDULE
  NUMBER OF DESCENT STEPS     NINDE        15
  MINIMUM DESCENT MACH NO.    DEMMIN     0.30000E+00
FLOPS COST CALCULATION DATA
  TYPE OF COST CALCULATION    ICOSTP        5
  R&D SWITCH                  IRAD          1
  YEAR FOR CALCULATIONS       DYEAR      0.19870E+04   (year)
  DEVELOPMENT START TIME      DEVST      0.19700E+04   (year)
  FAA CERTIFICATION DATE      PLMQT      0.19800E+04   (year)
  SPARES FACTOR FOR AIRFRAME  FAFMSP     0.10000E+00
  SPARES FACTOR FOR ENGINES   FENGSP     0.30000E+00
  AIRFRAME PRODUCTION QUANT.  Q        0.40000E+03
```

Listing of the *neutral.add* file (Continued)

NO OF PROTOTYPE AIRCRAFT	NPROTP	2	
NO OF FLIGHT TEST AIRCRAFT	NFLTST	2	
SPARES FACTOR FOR DEVELOP.	FPPFT	0.50000E+00	
ENGINE PRESSURE RATIO	EPR	0.24200E+02	
FLOPS ENGINE DESIGN SFC	FLSFC	0.62000E+00	(lb/hr/lb)
MAX TURBINE INLET TEMP	TEMPTUR	0.22820E+04	(deg. F)
BODY TYPE SWITCH	IBODY	1	
CIRCUIT INDICATOR	ICIRC	2	
AC TOTAL PACK FLOW	AC	0.33000E+03	(lb/min)
APU FLOW RATE	APUFLW	0.38500E+03	(lb/min)
APU SHAFT HORSEPOWER	APUSHP	0.17000E+03	(hp)
HYDRAULIC PUMP FLOW RATE	HYDGPM	0.15000E+03	(gal/min)
KVA RATING OF FULLTIME GENS	KVA	0.30000E+03	(kva)
NO OF APUS	NAPU	1	
NO OF AUTOPILOT CHANNELS	NCHAN	2	
NO OF INFLIGHTOPERATED GENS	NGEN	4	
MANUFACTURERS PROFIT RATE	PRORAT	0.15000E+02	(%
DEPRECIATION PERIOD	DEPPER	0.14000E+02	(years)
FARE	FARE	0.09450E+00	($/pass/mile)
FUEL PRICE	FUELPR	0.50000E+00	($/gal)
TAX RATE FOR ROI CALCUL.	TAXRAT	0.33000E+00	
NO OF PODDED ENGINES	NPOD	2	
DIRECT LABOR BURDEN FACTOR	DLBUR	0.20000E+01	
NO OF YEARS FOR LCC CALCUL.	LIFE	0.14000E+02	(years)
RESIDUAL AT END OF DEPPER	RESID	0.15000E+02	(%)
RETURN ON INVESTMENT	ROI	0.70000E+01	(%)
LOAD FACTOR	LF	0.55000E+02	(%)
% OF SEATS FOR 1ST CLASS	PCTFC	0.10000E+02	(%)
MULTIPLEX INDICATOR	IMUX	1	(YES=0, NO=1)
AUXILIARY POWER INDICATOR	ISPOOL	1	(SINGLE=0, DOUBLE=1)

C.2 NNEPWATE Module: performs engine cycle analysis and weight estimation of the engine

The engine input and map files are prepared by the user prior to running T/BEST. The NNEPWATE module is executed independently of the neutral file. The NNEPPOST module updates the neutral file for output parameters obtained from NNEPWATE.

C.3 NNEPPOST Module: post-process the output from the NNEPWATE module

Input Parameters	*Output Parameters*	
None	For FAN, HPC, LPC, HPT, and LPT:	
	ENGINE COMPONENT TYPE: ---	NCC
	NUMBER OF STAGES	NSTAGE
	ROTOR SPEED	RPM
	MAXIMUM ROTOR SPEED	RPMAX
	BLADE TAPER RATIO (HUB/TIP)	TR
	UPSTREAM HUB RADIUS	RIUP1
	DOWNSTREAM HUB RADIUS	RIDW1
	UPSTREAM SHROUD RADIUS	ROUP1
	STAGE NUMBER	NS
	NUMBER OF BLADES	NB
	STAGE WEIGHT	NSTW
	HUB RADIUS	RHBA
	TIP RADIUS	RTBA
	ASPECT RATIO	AR
	MAXIMUM TEMPERATURE	TMAX
	STAGE LENGTH	STL
	1ST STATION CHORD LENGTH	CHORD(1)
	STAGE PRESSURE RATIO	PR
	STAGE PRESSURE	STAGEP
	STAGE TEMPERATURE	STAGET
	STAGE MASS FLOW RATE	STAGEF
	BLADE MATERIAL	MATSLC
	1ST STAGE WEIGHT FLOW RATE	XFLOW
	1ST STAG RELATIVE TIP SPEED	XVR
	1ST STAGE ROTATIVE RPM	XRPM
	1ST STA. ROT-STAT AXIAL GAP	XGAP
	1ST ROT-STA TIP AXIAL CHORD	XCHORD
	NOZZLE INNER RADIUS	RI
	NOZZLE OUTER RADIUS	RO
	For all other components:	
	ENGINE COMPONENT TYPE: ----	NCC
	MATERIAL	CMPMAT
	PROCESS	TYPROC
	DUCT WEIGHT	WGHT
	STOCK MATERIAL WEIGHT	SWGHT
	MAURER WEIGHT FACTOR	MAURER
	COST TO MANUFACTURE ONE	COST1
	INNER RADIUS	RIN
	OUTER RADIUS	ROUT
	COMPONENT LENGTH	LENGTH
	SHAFT DN	DN

Following the execution of NNEPPOST, the neutral file of the T/BEST executive system is generated. It appends the *neutral.add* file discussed in section C.1 and a section of defaulted parameters with the data from NNEPWATE to form *neutral.file*.. When executing NEUTGEN, the user may assign a specific value to any parameters in the neutral file. If a value is assigned to a parameter, than that value and the keyword of that parameter are stored in a file called *neutral.modify* in the T/BEST input directory. This file is read by NNEPPOST and the newly read values are assigned to the associated parameters when the neutral file is written.

List of *neutral.file* Default Parameters

BLADE BROACH ANGLE	BRANG	0.00000E+00	(deg.)
BLADE STAGGER ANGLE	STAGG	0.35000E+02	(deg.)
AIRCRAFT GROSS WEIGHT	GW	0.59696E+06	(lbs.)
AIRFRAME WEIGHT	AW	0.24832E+06	(lbs.)
CAPACITY WEIGHT	CW	0.16195E+06	(lbs.)
FUEL WEIGHT	FW	0.15659E+06	(lbs.)
CAPACITY+FUEL WEIGHT	TW	0.31854E+06	(lbs.)
NUMBER OF ENGINES	NE	4	
LANDING WEIGHT	WFF	0.00000E+00	(lbs.)
AIRCRAFT LIFT/DRAG RATIO	ALD	0.15810E+02	
INLET FLOW AREA	XAF	0.00000E+00	(sq. ft)
AFT DUCT AREA	XAR	0.00000E+00	(sq. ft.)
NOZZLE (PASSAGE) HEIGHT	XAH	0.00000E+00	(in.)
TEMPERATURE	XT	0.59000E+02	(F)
RELATIVE HUMIDITY	XRH	0.70000E+02	(%)
SIDELINE DISTANCE	XDIST	0.50000E+03	(ft.)
TARGET PERCEIVED NOISE LEV.	XPNL	0.90000E+02	(PNdB)
50 DEG.PERCEIVED NOISE LEV.	XPNDBF	0.00000E+00	(PNdB)
120DEG.PERCEIVED NOISE LEV.	XPNDBR	0.00000E+00	(PNdB)

C.4 BLASIMGEN Module: generates input for the BLASIM module

Input Parameters		*Output Parameters*
ENGINE COMPONENT TYPE: FAN	NCC	None
NUMBER OF STAGES	NSTAGE	
ROTOR SPEED	RPM	
MAXIMUM ROTOR SPEED	RPMAX	
BLADE TAPER RATIO (HUB/TIP)	TR	
UPSTREAM HUB RADIUS	RIUP1	
DOWNSTREAM HUB RADIUS	RIDW1	
UPSTREAM SHROUD RADIUS	ROUP1	
STAGE NUMBER	NS	
NUMBER OF BLADES	NB	
HUB RADIUS	RHBA	
TIP RADIUS	RTBA	
ASPECT RATIO	AR	
MAXIMUM TEMPERATURE	TMAX	
BLADE ROOT ANGLE	THER	
BLADE BROACH ANGLE	BRANG	
BLADE STAGGER ANGLE	STAGG	
1ST STATION CHORD LENGTH	CHORD(1)	
STAGE PRESSURE RATIO	PR	
BLADE MATERIAL	MATSLC	
AIRFOIL DEFINITION	AIRCODE	
FULL BLADE DEFINITION	ABLDEF	

C.5 BLASIM Module: performs structural analysis of the blade

The input to this module for all stages of each fan, compressor, and turbine is generated by the BLASIMGEN module. BLASIM is executed independently of the neutral file . Note that the BLASIM input generator and post-processor the carry out the data transfer with the T/BEST executive system.

C.6 BLASIMPOST Module: post-process the output from the BLASIM module for each stage of fans, compressors and turbines.

Input Parameters		*Output Parameters*	
ENGINE COMPONENT TYPE: FAN	NCC	BLADE UNTWIST	UTWIST
NUMBER OF STAGES	NSTAGE	BLADE UNCAMBER	UCAMB
STAGE NUMBER	NS	MAXIMUM TIP EXTENSION	TIPX
ENGINE COMPONENT TYPE: HPC	NCC	MAX. IN PLANE Y-DISPL.	TIPY
NUMBER OF STAGES	NSTAGE	MAX. IN PLANE Z-DISPL.	TIPZ
STAGE NUMBER	NS	For next 5 modes	
ENGINE COMPONENT TYPE: LPC	NCC	FREQUENCY AT MIN. CRUISE	WMC1
NUMBER OF STAGES	NSTAGE	FREQUENCY AT ROTOR SPEED	w1
STAGE NUMBER	NS	FREQUENCY AT MAX. SPEED	WRL1
ENGINE COMPONENT TYPE: LPT	NCC	MAXIMUM RESONANCE MARGIN	MAXMR11
NUMBER OF STAGES	NSTAGE	MAXIMUM RESONANCE MARGIN	MAXMR12
STAGE NUMBER	NS	MAXIMUM RESONANCE MARGIN	MAXMR13
ENGINE COMPONENT TYPE: HPT	NCC	MAXIMUM RESONANCE MARGIN	MAXMR14
NUMBER OF STAGES	NSTAGE	MAXIMUM RESONANCE MARGIN	MAXMR15
STAGE NUMBER	NS	FREQUENCY AT MIN. CRUISE	WMC2
		MAX. MARGIN GOODMAN DIAG.	PMODE1
		MAX. MARGIN GOODMAN DIAG.	PMODE2
		MAX. MARGIN GOODMAN DIAG.	PMODE3
		MAX. MARGIN GOODMAN DIAG.	PMODE4
		MAX. MARGIN GOODMAN DIAG.	PMODE5
		ROOT STRESS	RSTRES
		MDE BLADE ROOT RESPONSE	FROOT
		BLADE WEIGHT	WGHT
		FOREIGN OBJECT VELOCITY	VELFOD
		FOREIGN OBJECT RADIUS	RADFOD
		IMPACT ANGLE	ANGFOD
		STAGGER ANGLE AT IMPACT	STAFOD
		FOREIGN OBJECT DENSITY	DENFOD
		IMPACT MAX. EDGE STRAIN	STRAIN
		IMPACT ROOT DAMAGE	ROOTD

C.7 MTSBGEN Module: generates input for the MTSB module

Input Parameters		*Output Parameters*
ENGINE COMPONENT TYPE: FAN	NCC	None
NUMBER OF STAGES	NSTAGE	
ROTOR SPEED	RPM	
BLADE TAPER RATIO (HUB/TIP)	TR	
UPSTREAM HUB RADIUS	RIUP1	
DOWNSTREAM HUB RADIUS	RIDW1	
UPSTREAM SHROUD RADIUS	ROUP1	
STAGE NUMBER	NS	
NUMBER OF BLADES	NB	
STAGE WEIGHT	NSTW	
HUB RADIUS	RHBA	
TIP RADIUS	RTBA	
ASPECT RATIO	AR	
MAXIMUM TEMPERATURE	TMAX	
BLADE ROOT ANGLE	THER	
STAGE LENGTH	STL	
1ST STATION CHORD LENGTH	CHORD(1)	
STAGE PRESSURE RATIO	PR	
STAGE PRESSURE	STAGEP	
STAGE TEMPERATURE	STAGET	
STAGE MASS FLOW RATE	STAGEF	
AIRFOIL DEFINITION	AIRCODE	

C.8 MTSB Module: transonic flow solution

The MTSB input file for all stages of each fan, compressor, and turbine is generated by the MTSBGEN module. MTSB is executed independently of the neutral file. The input generator and post-processor of the MTSB module access the T/BEST neutral file to retrieve/update parameters.

C.9 MTSBPOST Module: post-process the output from the mtsb module for each stage of fans, compressors and turbines

Input Parameters		*Output Parameters*	
ENGINE COMPONENT TYPE: FAN	NCC	EFFICIENCY (KINETIC)	EFNCY
NUMBER OF STAGES	NSTAGE	PROFILE EFFICIENCY	EPROF
STAGE NUMBER	NS	ENDWALL EFFICIENCY	ENDWA
ENGINE COMPONENT TYPE: HPC	NCC	SEC. LOSS EFFICIENCY	ESECL
NUMBER OF STAGES	NSTAGE	INCIDENCE EFFICIENCY	EINCD
STAGE NUMBER	NS	CLEARANCE EFFICIENCY	ECLEA
ENGINE COMPONENT TYPE: LPC	NCC	WINDAGE EFFICIENCY	EWIND
NUMBER OF STAGES	NSTAGE	SUM ROTOR EFFICIENCY	ESUMR
STAGE NUMBER	NS		
ENGINE COMPONENT TYPE: LPT	NCC		
NUMBER OF STAGES	NSTAGE		
STAGE NUMBER	NS		
ENGINE COMPONENT TYPE: HPT	NCC		
NUMBER OF STAGES	NSTAGE		
STAGE NUMBER	NS		

C.10 NOISE Module: estimates the fan tone, broadband and jet noise

Input Parameters		*Output Parameters*	
1ST STAGE WEIGHT FLOW RATE	XFLOW	50 DEG.PERCEIVED NOISE LEV.	XPNDBF
1ST STAG RELATIVE TIP SPEED	XVR	120DEG.PERCEIVED NOISE LEV.	XPNDBR
1ST STAGE ROTATIVE RPM	XRPM		
1ST STA. ROT-STAT AXIAL GAP	XGAP		
1ST ROT-STA TIP AXIAL CHORD	XCHORD		
INLET FLOW AREA	XAF		
AFT DUCT AREA	XAR		
NOZZLE INNER RADIUS	RI		
NOZZLE OUTER RADIUS	RO		
NOZZLE (PASSAGE) HEIGHT	XAH		
TEMPERATURE	XT		
RELATIVE HUMIDITY	XRH		
SIDELINE DISTANCE	XDIST		
TARGET PERCEIVED NOISE LEV.	XPNL		
ENGINE COMPONENT TYPE: FAN	NCC		
STAGE NUMBER	NS =1		
NUMBER OF BLADES	NB		
HUB RADIUS	RHBA		
TIP RADIUS	RTBA		
1ST STATION CHORD LENGTH	CHORD(1)		
JET VELOCITY	XVJ		

C.11 PREDICT Module: predicts gross, airframe, engine, capacity and fuel weights

Input Parameters		*Output Parameters*	
AIRCRAFT GROSS WEIGHT	GW	AIRCRAFT GROSS WEIGHT	GW
AIRFRAME WEIGHT	AW	AIRFRAME WEIGHT	AW
CAPACITY WEIGHT	CW	CAPACITY WEIGHT	CW
FUEL WEIGHT	FW	FUEL WEIGHT	FW
CAPACITY+FUEL WEIGHT	TW	CAPACITY+FUEL WEIGHT	TW
WEIGHT OF BARE ENGINE	EN	WEIGHT OF BARE ENGINE	EN
WEIGHT OF ENGINE ACESSORIES	EA	WEIGHT OF ENGINE ACESSORIES	EA
FUEL CONSUMED AT CRUISE	FCR		

C.12 RANGE Module: computes the cruise-climb range

Input Parameters		*Output Parameters*	
AIRCRAFT GROSS WEIGHT	GW	AIRCRAFT LIFT/DRAG RATIO	ALD
FUEL WEIGHT	FW	CRUISE ALTITUDE	ALT
LANDING WEIGHT	WFF	CRUISE SPEED	VC
AIRCRAFT LIFT/DRAG RATIO	ALD	CRUISE SPECIFIC FUEL CONSUP	SFCC
CRUISE ALTITUDE	ALT	CRUISE THRUST	ATC
ALTITUDE	CALT	RANGE	RANGE
SPEED	V	BREGUET RANGE	BRANGE
GROSS THRUST	AT		
SPECIFIC FUEL CONSUMPT.	SFC		

C.13 CITY Module: estimates the number of city pairs in the US. and Western Europe.

Input Parameters		*Output Parameters*	
RANGE	RANGE	U. S. CITY PAIRS	USCITY
		WESTERN EUROPE CITY PAIRS	INTCITY

C.14 REPAIR Module: computes mean time between engine repair, material, and labor

Input Parameters		*Output Parameters*	
ALTITUDE	CALT	TIME BETWEEN ENG. OVERHAULS	HEO
PRESSURE AT INLET	PFAN1	HIGH PRESSURE COMPRES MTBR	HCMTBR
TEMPERATURE AT INLET	TFAN1	INLET MEAN TIME REPAIR	INMTBR
PRESSURE AT INLET	PLPC1	DUCT MEAN TIME REPAIR	DUMTBR
TEMPERATURE AT INLET	TLPC1	BURNER MEAN TIME REPAIR	BUMTBR
PRESSURE AT EXIT	PFAN2	AUGMENTER MEAN TIME REPAIR	AUMTBR
TEMPERATURE AT EXIT	TFAN2	MIXER MEAN TIME REPAIR	FMMTBR
PRESSURE AT EXIT	PHPC2	NOZZLE MEAN TIME REPAIR	NOMTBR
TEMPERATURE AT EXIT	THPC2	SHAFT MEAN TIME REPAIR	SHMTBR
PRESSURE AT EXIT	PPBU2	DIFFUSER MTBR	DIFMTBR
TEMPERATURE AT EXIT	TPBU2	COMBUSTOR MTBR	CBMTBR
PRESSURE AT EXIT	PHPT2	HIGH PRESSURE TURBINE MTBR	HTMTBR
TEMPERATURE AT EXIT	THPT2	LOW PRESSURE TURBINE MTBR	LTMTBR
PRESSURE AT EXIT	PLPT2	LOW PRESSURE COMPRESS LABOR	LCHOURS
TEMPERATURE AT EXIT	TLPT2	HIGH PRESSURE COMPRES LABOR	HCHOURS
CRUISE ALTITUDE	ALT	INLET LABOR	INHOURS
ENGINE COMPONENT TYPE: FAN	NCC	DUCT LABOR	DUHOURS
NUMBER OF STAGES	NSTAGE	BURNER LABOR	BUHOURS
ROTOR SPEED	RPM	AUGMENTER LABOR	AUHOURS
STAGE NUMBER	NS	MIXER LABOR	FMHOURS
TIP RADIUS	RTBA	NOZZLE LABOR	NOHOURS
ENGINE COMPONENT TYPE: LPC	NCC	SHAFT LABOR	SHHOURS
NUMBER OF STAGES	NSTAGE	DIFFUSER LABOR	DIFHOURS
ROTOR SPEED	RPM	COMBUSTOR LABOR	CBHOURS
STAGE NUMBER	NS	HIGH PRESSURE TURBINE LABOR	HTHOURS
TIP RADIUS	RTBA	LOW PRESSURE TURBINE LABOR	LTHOURS
ENGINE COMPONENT TYPE: HPC	NCC	LPC MATERIALS COST	LCCOST
NUMBER OF STAGES	NSTAGE	HPC MATERIALS COST	HCCOST
ROTOR SPEED	RPM	INLET MATERIALS COST	INCOST
STAGE NUMBER	NS	DUCT MATERIALS COST	DUCOST
TIP RADIUS	RTBA	BURNER MATERIALS COST	BUCOST
ENGINE COMPONENT TYPE: HPT	NCC	AUGMENTER MATERIALS COST	AUCOST
NUMBER OF STAGES	NSTAGE	MIXER MATERIALS COST	FMCOST
ROTOR SPEED	RPM	NOZZLE MATERIALS COST	NOCOST
STAGE NUMBER	NS	SHAFT MATERIALS COST	SHCOST
TIP RADIUS	RTBA	DIFFUSER MATERIALS COST	DIFCOST
ENGINE COMPONENT TYPE: LPT	NCC	COMBUSTOR MATERIALS COS	CBCOST
NUMBER OF STAGES	NSTAGE	HPT MATERIALS COST	HTCOST
ROTOR SPEED	RPM	LPT MATERIALS COST	LTCOST
STAGE NUMBER	NS		
TIP RADIUS	RTBA		
NUMBER OF ENGINES	NE		
TIME BETWEEN ENG. OVERHAULS	HEO		
LOW PRESSURE COMPRESS PRICE	LCPRICE		
HIGH PRESSURE COMPRES PRICE	HCPRICE		
INLET PRICE	INPRICE		
DUCT PRICE	DUPRICE		
BURNER PRICE	BUPRICE		
AUGMENTER PRICE	AUPRICE		
MIXER PRICE	FMPRICE		
NOZZLE PRICE	NOPRICE		
SHAFT PRICE	SHPRICE		
DIFFUSER PRICE	DIFPRICE		
COMBUSTOR PRICE	CBPRICE		
HIGH PRESSURE TURBINE PRICE	HTPRICE		
LOW PRESSURE TURBINE PRICE	LTPRICE		

C.15 DOC Module: computes direct operating cost

Input Parameters		*Output Parameters*	
AIRCRAFT GROSS WEIGHT	GW	AIRCRAFT GROSS WEIGHT	GW
AIRFRAME WEIGHT	AW	AIRFRAME WEIGHT	AW
FUEL WEIGHT	FW	FUEL WEIGHT	FW
WEIGHT OF BARE ENGINE	EN	WEIGHT OF BARE ENGINE	EN
ALTITUDE	CALT	ALTITUDE	CALT
INSTALLED THRUST	ATI	INSTALLED THRUST	ATI
SPEED	V	SPEED	V
SPECIFIC FUEL CONSUMPT.	SFC	SPECIFIC FUEL CONSUMPT.	SFC
CRUISE ALTITUDE	ALT	CRUISE ALTITUDE	ALT
RANGE	RANGE	RANGE	RANGE
TIME TO CLIMB	TC	TIME TO CLIMB	TC
TIME TO DECEND	TD	TIME TO DECEND	TD
DAY NITE FACTOR	DNF	DAY NITE FACTOR	DNF
SPARE PARTS FACTOR	SPF	SPARE PARTS FACTOR	SPF
CAPTAIN'S PAY	ODPP	CAPTAIN'S PAY	ODPP
COPILOT'S PAY	ODPCP	COPILOT'S PAY	ODPCP
FLIGHT'S ENGINEER PAY	ODPFE	FLIGHT'S ENGINEER PAY	ODPFE
DOMESTIC TRAVEL FACTOR	ED	DOMESTIC TRAVEL FACTOR	ED
INTERNATIONAL TAVEL FACTOR	EI	INTERNATIONAL TAVEL FACTOR	EI
TRAINING FACTOR	KT	TRAINING FACTOR	KT
VACATION FACTOR	KV	VACATION FACTOR	KV
CREW PREMIUM FACTOR	KP	CREW PREMIUM FACTOR	KP
PAYROLL TAX FACTOR	KI	PAYROLL TAX FACTOR	KI
ANNUAL FLIGHT HOURS (U.S.A)	AHD	ANNUAL FLIGHT HOURS (U.S.A)	AHD
ANNUAL FLIGHT HOURS (INT.)	AHI	ANNUAL FLIGHT HOURS (INT.)	AHI
CAPTAIN'S BASE PAY	BPP	CAPTAIN'S BASE PAY	BPP
1ST OFFICER'S BASE PAY	BPCP	1ST OFFICER'S BASE PAY	BPCP
FLIGHT ENGINEER'S BASE PAY	BPFE	FLIGHT ENGINEER'S BASE PAY	BPFE
FUEL COST (USA)	AFUELD	FUEL COST (USA)	AFUELD
FUEL COST (INTERNATIONAL)	AFUELI	FUEL COST (INTERNATIONAL)	AFUELI
JET OIL COST (US)	BOILTD	JET OIL COST (US)	BOILTD
JET OIL COST (INT.)	BOILTI	JET OIL COST (INT.)	BOILTI
ENGINE OIL (US)	BOILRD	ENGINE OIL (US)	BOILRD
ENGINE OIL (INT.)	BOILRI	ENGINE OIL (INT.)	BOILRI
FUEL CONSUMED AT CRUISE	FCR	FUEL CONSUMED AT CRUISE	FCR
FUEL USED IN CLIMB	FCL	FUEL USED IN CLIMB	FCL
FUEL USED IN DESCENT	FD	FUEL USED IN DESCENT	FD
FUEL FOR GROUND MANEUVERS	FGM	FUEL FOR GROUND MANEUVERS	FGM
DISTANCE FOR CLIMB	DC	DISTANCE FOR CLIMB	DC
DISTANCE DESCENT	DD	DISTANCE DESCENT	DD
MANEUVERING DISTANCE	DAM	MANEUVERING DISTANCE	DAM
COST OF COMPLETE AIRPLANE	CT	COST OF COMPLETE AIRPLANE	CT
COST OF AIRPLANE LESS ENG.	CSPA	COST OF AIRPLANE LESS ENG.	CSPA
COST OF AIR. LESS ENG,PROP	CA	COST OF AIR. LESS ENG,PROP	CA
COST OF ONE ENGINE	CE	COST OF ONE ENGINE	CE
COST OF ONE PROP	CP	COST OF ONE PROP	CP
NUMBER OF PROPS	ANP	NUMBER OF PROPS	ANP
TIME BETWEEN ENG. OVERHAULS	HEO	TIME BETWEEN ENG. OVERHAULS	HEO
TAKEOFF EQUIV. HORSE POWER	ESHP	TAKEOFF EQUIV. HORSE POWER	ESHP
DENSITY OF FUEL	WF	DENSITY OF FUEL	WF
DENSITY OF OIL	WO	DENSITY OF OIL	WO
INSURANCE RATE DOLLAR/VALUE	AIRA	INSURANCE RATE DOLLAR/VALUE	AIRA
INSURANCE: LIABILITY&DAMAGE	PLPD	INSURANCE: LIABILITY&DAMAGE	PLPD
LABOR COST	RL	LABOR COST	RL
AIRPLANE DEPRECIAT. FACTOR	AKDA	AIRPLANE DEPRECIAT. FACTOR	AKDA

Input Parameters (Continued)		*Output Parameters (Continued)*	
ENGINE DEPRECIATION FACTOR	AKDE	ENGINE DEPRECIATION FACTOR	AKDE
PROP DEPRECIATION FACTOR	AKDP	PROP DEPRECIATION FACTOR	AKDP
SPARE AIRPLANE DEPRECIATION	AKDSA	SPARE AIRPLANE DEPRECIATION	AKDSA
SPARE ENGINE DEPRECIATION	AKDSE	SPARE ENGINE DEPRECIATION	AKDSE
AIRFRAME DEPRECIATION	DA	AIRFRAME DEPRECIATION	DA
ENGINE DEPRECIATION	DE	ENGINE DEPRECIATION	DE
PROP DEPRECIATION	DP	PROP DEPRECIATION	DP
SPARE AIRFRAME DEPRECIATION	DAS	SPARE AIRFRAME DEPRECIATION	DAS
SPARE ENGINE DEPRECIATION	DES	SPARE ENGINE DEPRECIATION	DES
AIRPLANE SPARES/AIR. PRICE	AKSPA	AIRPLANE SPARES/AIR. PRICE	AKSPA
ENGINE SPARES/ENGINE PRICE	AKSPE	ENGINE SPARES/ENGINE PRICE	AKSPE
		BLOCK FUEL	FB
		CAPTAIN GROSS WEIGHT FACTOR	GWFP
		1ST OF. GROSS WEIGHT FACTOR	GWFCP
		FLT. ENG. GROSS WT. FACTOR	GWFFE
		CAPTAIN MILEAGE RATE FACTOR	XMRFP
		1ST OF. MILEAGE RATE FACTOR	XMRCP
		FLT ENG MILEAGE RATE FACTOR	XMRFE
		TIME TO CRUISE DOMESTIC	TGD
		GROUND MANUEVERING TIME	TGM
		DOMESTIC BLOCK TIME	TBD
		DOMESTIC BLOCK SPEED	VBD
		DOM. TURBINE AIRCRAFT UTIL.	UTD
		DOM. RECP. ENG. AIR. UTIL.	URD
		INTERNATIONAL BLOCK SPEED	VBI
		INTERNATIONAL BLOCK TIME	TBI
		TIME TO CRUISE INTERNAT.	TGI
		INT TURBINE AIR. UTILIZAION	UTI
		INT RECP. ENG. AIR. UTIL.	URI
		CAPTAINS DOMESTIC COST	CAMPD
		1S OFFICERS DOMESTIC COST	CAMCPD
		FLIGHT ENG. DOMESTIC COST	CAMFED
		DOMESTIC FUEL COST	CFTD
		DOMESTIC OIL COST	COTD
		DOMESTIC INSURANCE COSTS	CINTD
		DOM TURB AIRFR LABOR COST	ALBTD
		DOM TURB AIRFR BURDEN COST	ALBTDMB
		DOM REC ENG AIR LABOR COST	ALBRD
		DOM REC ENG BURDEN COST	ALBRDMB
		DOM TURB ENG LABOR MAINT.	ELBTD
		DOM TURB ENG BURDEN COST	ELBTDMB
		DOM TURBPROP ENG LABOR MAIN	ELBPD
		DOM TURBPROP ENG BURDEN	ELBPDMB
		DOM REC ENG. LABOR MAINT.	ELBRD
		DOM REC ENG MAINT BURDEN	ELBRDMB
		DOM TURB ENG AIR MAINT MATE	CMATD
		DOM TURB ENG AIR MAINT BURD	CMATDMB
		DOM REC ENG AIR MAINT MATE	CMARD
		DOM REC ENG AIR MAINT BURD	CMARDMB
		DOM TURB ENG MAINT MATERIAL	CMETD
		DOM TURB ENG MAINT BURDEN	CMETDMB
		DOM REC ENG MAINT MATERIALS	CMERD
		DOM REC ENG MAINT BURDEN	CMERDMB
		DOM TURB AIR APP MAINT BURD	CMBTD
		DOM REC ENG AIR APP BURDEN	CMBRD
		DOM TURBPROP AIR. APP. BURD	CMBPD

Output Parameters (Continued)

DOM TURB AIR DEPRECIATION	CDATD
DOM REC ENG AIRCRAFT DEPREC	CDARD
DOM TURB ENG DEPRECIATION	CDETD
DOM. REC. ENG DEPRECIATION	CDERD
DOM SPARE TURB AIR. DEPRECI	DSATD
DOM SPARE REC ENG AIR DEPRE	DSARD
DOM. SPARE TURB ENG DEPRECI	DSETD
DOM. SPARE REC. ENG DEPRECI	DSERD
DOM. SPARE PROP DEPRECIATIO	CDPD
INTERNATIONAL FUEL COSTS	CFTI
INTERNATIONAL OIL COSTS	COTI
INTERNATIONAL INSURANCE	CINTI
INT. TURB AIRFRAME LABOR	ALBTI
INT. REC. ENG. AIR LABOR	ALBRI
INT. TURB ENG LABOR MAINTE	ELBTI
INT TURBPROP ENG. LABOR MAI	ELBPI
INT REC ENG LABOR MAINTENAN	ELBRI
INT TURB ENG AIR MAIN MATER	CMATI
INT REC ENG AIR MAINT MATER	CMARI
INT TURB ENG MAINT MATERIAL	CMETI
INT REC ENG MAINT MATERIALS	CMERI
INT TURB AIR APP MAINT BURD	CMBTD
INT REC ENG AIR APP BURD	CMBRD
INT. TURBOPROP AIR APP BURD	CMBPD
INT. TURB AIR DEPRECIATION	CDATI
INT REC ENG AIR DEPRECIATIO	CDARI
INT TURB ENG DEPRECIATION	CDETI
INT. REC. ENG DEPRECIATION	CDERI
INT. SPARE TURB. AIR DEPREC	DSATI
INT SPARE REC ENG AIR DEPR	DSARI
INT. SPARE TURB ENG DEPRECI	DSETI
INT. SPARE REC. ENG DEPRECI	DSERI
INT. SPARE PROP DEPRECIATIO	CDPI

C.16 LCC Module: estimates engine maintenance cost for a year of service

Input Parameters		*Output Parameters*	
NUMBER OF ENGINES	NE	NEW JET/FAN MAIN. COST 1YR	NEWT1
ANNUAL FLIGHT HOURS (U.S.A)	AHD	DERIVATIVE JET/FAN ENG 1YR	DERT1
GROUND MANUEVERING TIME	TGM	NEW JET/FAN MAIN. COST 2YR	NEWT2
DOMESTIC BLOCK TIME	TBD	DERIVATIVE JET/FAN ENG 2YR	DERT2
DOMESTIC BLOCK SPEED	VBD	NEW JET/FAN MAIN. COST 3YR	NEWT3
DOM TURB ENG LABOR MAINT.	ELBTD	DERIVATIVE JET/FAN ENG 3YR	DERT3
DOM TURB ENG BURDEN COST	ELBTDMB	NEW JET/FAN MAIN. COST 4YR	NEWT4
DOM TURBPROP ENG LABOR MAIN	ELBPD	DERIVATIVE JET/FAN ENG 4YR	DERT4
DOM TURBPROP ENG BURDEN	ELBPDMB	NEW JET/FAN MAIN. COST 5YR	NEWT5
DOM REC ENG. LABOR MAINT.	ELBRD	DERIVATIVE JET/FAN ENG 5YR	DERT5
DOM REC ENG MAINT BURDEN	ELBRDMB	NEW JET/FAN MAIN. COST 6YR	NEWT6
DOM TURB ENG MAINT MATERIAL	CMETD	DERIVATIVE JET/FAN ENG 6YR	DERT6
DOM TURB ENG MAINT BURDEN	CMETDMB	NEW JET/FAN MAIN. COST 7YR	NEWT7
DOM REC ENG MAINT MATERIALS	CMERD	DERIVATIVE JET/FAN ENG 7YR	DERT7
DOM REC ENG MAINT BURDEN	CMERDMB	NEW JET/FAN MAIN. COST 8YR	NEWT8
		DERIVATIVE JET/FAN ENG 8YR	DERT8
		NEW JET/FAN MAIN. COST 9YR	NEWT9
		DERIVATIVE JET/FAN ENG 9YR	DERT9
		NEW JET/FAN MAIN. COST 10YR	NEWT10
		DERIVATIVE JET/FAN ENG 10YR	DERT10
		NEW JET/FAN MAIN. COST 11YR	NEWT11
		DERIVATIVE JET/FAN ENG 11YR	DERT11
		NEW JET/FAN MAIN. COST 12YR	NEWT12
		DERIVATIVE JET/FAN ENG 12YR	DERT12
		NEW JET/FAN 8YR TOTAL	NEWTJET
		DERIVATIVE JET/FAN 8YR TOTA	DERTJET
		NEW TURPROP MAIN. COST 1YR	NEWP1
		DERIVATIVE JET/FAN ENG 1YR	DERP1
		NEW TURPROP MAIN. COST 2YR	NEWP2
		DERIVATIVE JET/FAN ENG 2YR	DERP2
		NEW TURPROP MAIN. COST 3YR	NEWP3
		DERIVATIVE JET/FAN ENG 3YR	DERP3
		NEW TURPROP MAIN. COST 4YR	NEWP4
		DERIVATIVE JET/FAN ENG 4YR	DERP4
		NEW TURPROP MAIN. COST 5YR	NEWP5
		DERIVATIVE JET/FAN ENG 5YR	DERP5
		NEW TURPROP MAIN. COST 6YR	NEWP6
		DERIVATIVE JET/FAN ENG 6YR	DERP6
		NEW TURPROP MAIN. COST 7YR	NEWP7
		DERIVATIVE JET/FAN ENG 7YR	DERP7
		NEW TURPROP MAIN. COST 8YR	NEWP8
		DERIVATIVE JET/FAN ENG 8YR	DERP8
		NEW TURPROP MAIN. COST 9YR	NEWP9
		DERIVATIVE JET/FAN ENG 9YR	DERP9
		NEW TURPROP MAIN. COST 10YR	NEWP10
		DERIVATIVE JET/FAN ENG 10YR	DERP10
		NEW TURPROP MAIN. COST 11YR	NEWP11
		DERIVATIVE JET/FAN ENG 11YR	DERP11
		NEW TURPROP MAIN. COST 12YR	NEWP12
		DERIVATIVE JET/FAN ENG 12YR	DERP12
		NEW RECIENG 8YR TOTAL	NEWPJET
		DERIVATIVE RECIENG 8YR TOTA	DERPJET
		NEW RECIENG MAIN. COST 1YR	NEWR1
		DERIVATIVE RECIENG ENG 1YR	DERR1
		NEW RECIENG MAIN. COST 2YR	NEWR2
		DERIVATIVE RECIENG ENG 2YR	DERR2

Output Parameters (Continued)

NEW RECIENG MAIN. COST 3YR	NEWR3
DERIVATIVE RECIENG ENG 3YR	DERR3
NEW RECIENG MAIN. COST 4YR	NEWR4
DERIVATIVE RECIENG ENG 4YR	DERR4
NEW RECIENG MAIN. COST 5YR	NEWR5
DERIVATIVE RECIENG ENG 5YR	DERR5
NEW RECIENG MAIN. COST 6YR	NEWR6
DERIVATIVE RECIENG ENG 6YR	DERR6
NEW RECIENG MAIN. COST 7YR	NEWR7
DERIVATIVE RECIENG ENG 7YR	DERR7
NEW RECIENG MAIN. COST 8YR	NEWR8
DERIVATIVE RECIENG ENG 8YR	DERR8
NEW RECIENG MAIN. COST 9YR	NEWR9
DERIVATIVE RECIENG ENG 9YR	DERR9
NEW RECIENG MAIN. COST 10YR	NEWR10
DERIVATIVE RECIENG ENG 10YR	DERR10
NEW RECIENG MAIN. COST 11YR	NEWR11
DERIVATIVE RECIENG ENG 11YR	DERR11
NEW RECIENG MAIN. COST 12YR	NEWR12
DERIVATIVE RECIENG ENG 12YR	DERR12
NEW RECIENG 8YR TOTAL	NEWRENG
DERIVATIVE RECIENG 8YR TOTA	DERRENG

C.17 FLOPSGEN Module: generates input for the FLOPS module

Input Parameters		*Output Parameters*	
AIRCRAFT GROSS WEIGHT	GW	FLOPS PROBLEM TYPE	IOPT
WEIGHT of BARE ENGINE	EN	FLOPS ANALYSIS OPTION	IANAL
ESTIMATED TOTAL LENGTH	TLEN	FLOPS COST ANALYSIS FLAG	ICOST
ESTIMATED MAXIMUM RADIUS	RADMAX	STRUCTURAL ULTIMATE LOAD	ULF
NUMBER OF ENGINES	NE	DIHEDRAL (POSITIVE)	DIH
CRUISE ALTITUDE	ALT	AREA	SHT
CRUISE SPEED	VC	1/4 CHORD SWEEP ANGLE	SWPHT
CRUISE THRUST	ATC	ASPECT RATIO	ARHT
RANGE	RANGE	TAPER RATIO	TRHT
		T/C	TCHT
		LOCATION ON VERTICAL TAIL	HHT
		NUMBER OF VERTICAL TAILS	NVERT
		AREA	SVT
		1/4 CHORD SWEEP ANGLE	SWPVT
		ASPECT RATIO	ARVT
		TAPER RATIO	TRVT
		T/C	TCVT
		NUMBER OF FUSELAGES	NFUSE
		TOTAL LENGTH	XL
		MAXIMUM WIDTH	WF
		MAXIMUM DEPTH	DF
		CARGO AIRCRAFT FACTOR	CARGF
		PASSENGER COMPART LENGTH	XLP
		LENGTH OF MAIN GEAR	XMLG
		LENGTH OF NOSE GEAR	XNLG
		CARRIER BASED AIRCRAFT	CARBAS
		NUMBER OF ENGINES ON WING	NEW
		NUMBER OF ENGINES ON FUSE	NEF
		BASELINE ENGINE THRUST	THRSO
		BASELINE ENGINE WEIGHT	WENG
		WEIGHT SCALING PARAMETER	EEXP
		BASELINE NACELLE LENGTH	XNAC
		BASELINE NACELLE DIAMETER	DNAC
		FUEL CAPACITY OF WING	FULWMX
		FUEL CAPACITY OF FUSELAGE	FULFMX
		AUX. TANK FUEL CAPACITY	FULAUX
		NUMBER OF FUEL TANKS	NTANK
		ADDED MISC PROP SYSTEM WT	WPMISC
		FIRST CLASS PASSENGERS	NPF
		TOURIST PASSENGERS	NPT
		STEWARDESSES	NSTU
		GALLEY CREW	NGALC
		FLIGHT CREW	NFLCR
		WEIGHT PER PASSENGER	WPPASS
		BAGGAGE PER PASSENGER	BPP
		THRUST REVERSERS - TOTAL	WTHR
		DESIGN RANGE	DESRNG
		WING LOADING REQUIRED	WSR
		THRUST/WEIGHT REQUIRED	TWR
		HORIZ TAIL VOLUME COEF	HTVC
		VERT TAIL VOLUME COEF	VTVC
		RAMP WEIGHT	GWFLOPS
		WING ASPECT RATIO	ARFLOPS
		WING TAPER RATIO	TRFLOPS
		WING 1/4 CHORD SWEEP	SWEEP
		WING THICKNESS-CHORD RATIO	TCA

Output Parameters (Continued)	
CRUISE MACH NUMBER	VCMN
MAX CRUISE ALTITUDE	CH
OBJ. FUN. WEIGHTING FACTOR	OFG
OBJ. FUN. WEIGHTING FACTOR	OFF
OBJ. FUN. WEIGHTING FACTOR	OFC
WING TECHNOLOGY	AITEK
FIXED DESIGN LIFT COEFFIC.	FCLDES
TURBULENT/LAMINAR FLOW	XLLAM
MAX. LANDING/TAKEOFF WEIGHT	WRATIO
MAX. LANDING VELOCITY	VAPPR
MAX. TAKEOFF FIELD LENGTH	FLTO
MAX. LANDING FIELD LENGTH	FLLDG
MAX. CL TAKEOFF CONFIG.	CLTOM
MAX. CL LANDING CONFIG.	CLLDM
AIR DENSITY RATIO	DRATIO
FLIGHT IDLE SWITCH	IDLE
INDICATOR OF ENGINE DECK	IGENEN
MIN IDLE FUEL FLOW FRACT	FIDMIN
MAX IDLE FUEL FLOW FRACT	FIDMAX
ENGINE DECK FILE NAME	EIFILE
PRINT MISSION CONTROL	IFLAG
DETAILED MISSION PRINT	MSUMPT
FLAG FOR RAMP WEIGHT ESTIM.	IRW
FUEL FLOW FACTOR	FACT
CDO FACTOR	FCDO
CDI FACTOR	FCDI
OWE FACTOR	OWFACT
RANGE TOLERANCE	RTOL
ATA TRAFFIC ALLOWANCE	IATA
WEIGHT INCREMENT	DWT
TAKEOFF TIME	TAKOTM
TAXI-OUT TIME	TAXOTM
TAXI-IN TIME	TAXITM
TAKEOFF POWER SETTING	ITTFF
MINIMUM CLIMB MACH NUMBER	CLMMIN
MINIMUM CLIMB ALTITUDE	CLAMIN
NUMBER OF CLIMB STEPS	NINCL
CLIMB OPTIMIZATION FACTOR	FWF
CRUISE OPTION SWITCH	IOC
MINIMUM MACH NUMBER	CRMMIN
MINIMUM DESCENT ALTITUDE	DEAMIN
MISSED APPROACH TIME	TIMMAP
RESERVE HOLDING TIME	HOLDTM
2ND RES HOLD TIME OR FRAC	THOLD
NUMBER OF DESCENT STEPS	NINDE
MINIMUM DESCENT MACH NO.	DEMMIN
WEIGHT COMPUTATION OPTION	MYWTS
DESIGN RANGE	DESRNG2
REQUIRED WING LOADING	WSR2
REQUIRED THRUST/WEIGHT	TWR2
TYPE OF COST CALCULATION	ICOSTP
R&D SWITCH	IRAD
YEAR FOR CALCULATIONS	DYEAR
DEVELOPMENT START TIME	DEVST
FAA CERTIFICATION DATE	PLMQT
SPARES FACTOR FOR AIRFRAME	FAFMSP
SPARES FACTOR FOR ENGINES	FENGSP
AIRFRAME PRODUCTION QUANT.	Q
NO OF PROTOTYPE AIRCRAFT	NPROTP

Output Parameters (Continued)	
NO OF FLIGHT TEST AIRCRAFT	NFLTST
SPARES FACTOR FOR DEVELOP.	FPPFT
ENGINE PRESSURE RATIO	EPR
FLOPS ENGINE DESIGN SFC	FLSFC
MAX TURBINE INLET TEMP	TEMPTUR
BODY TYPE SWITCH	IBODY
CIRCUIT INDICATOR	ICIRC
AC TOTAL PACK FLOW	AC
APU FLOW RATE	APUFLW
APU SHAFT HORSEPOWER	APUSHP
HYDRAULIC PUMP FLOW RATE	HYDGPM
KVA RATING OF FULLTIME GENS	KVA
NO OF APUS	NAPU
NO OF AUTOPILOT CHANNELS	NCHAN
NO OF INFLIGHTOPERATED GENS	NGEN
MANUFACTURERS PROFIT RATE	PRORAT
DEPRECIATION PERIOD	DEPPER
FARE	FARE
FUEL PRICE	FUELPR
TAX RATE FOR ROI CALCUL.	TAXRAT
NO OF PODDED ENGINES	NPOD
DIRECT LABOR BURDEN FACTOR	DLBUR
NO OF YEARS FOR LCC CALCUL.	LIFE
RESIDUAL AT END OF DEPPER	RESID
RETURN ON INVESTMENT	ROI
LOAD FACTOR	LF
% OF SEATS FOR 1ST CLASS	PCTFC
MULTIPLEX INDICATOR	IMUX
AUXILIARY POWER INDICATOR	ISPOOL

C.18 FLOPS Module: carries out mission performance and cost estimation

The input to FLOPS is generated by FLOPSGEN. The output from FLOPS is post-processed by FLOPSPOST. The input generator retrieves data from the neutral file while the post-processor updates it for output response parameters.

C.19 FLOPSPOST Module: post-process the FLOPS output from the

Input Parameters		Output Parameters	
FLOPS PROBLEM TYPE	IOPT	TAXI OUT INITIAL WEIGHT	WTAXOUT
FLOPS ANALYSIS OPTION	IANAL	TAXI OUT FUEL REQUIRED	FTAXOUT
FLOPS COST ANALYSIS FLAG	ICOST	TAKE OFF INITIAL WEIGHT	WTAXOFF
STRUCTURAL ULTIMATE LOAD	ULF	TAXI OFF FUEL REQUIRED	FTAXOFF
DIHEDRAL (POSITIVE)	DIH	CLIMB INITIAL WEIGHT	WTCLIMB
AREA	SHT	CLIMB FUEL REQUIRED	FLCLIMB
1/4 CHORD SWEEP ANGLE	SWPHT	CRUISE INITIAL WEIGHT	WTCRUIS
ASPECT RATIO	ARHT	CRUISE FUEL REQUIRED	FLCRUIS
TAPER RATIO	TRHT	DESCENT INITIAL WEIGHT	WTDESCE
T/C	TCHT	DESCENT FUEL REQUIRED	FLDESCE
LOCATION ON VERTICAL TAIL	HHT	ZERO FUEL INITIAL WEIGHT	WTZEROF
NUMBER OF VERTICAL TAILS	NVERT	TOTAL DESIGN RANGE	DERNMI
AREA	SVT	TOTAL FLIGHT TIME	TOTTIME
1/4 CHORD SWEEP ANGLE	SWPVT	TOTAL NITROGEN OXIDES EMISS	TOTNITR
ASPECT RATIO	ARVT	TIME SINCE TAKEOFF	TIME1
TAPER RATIO	TRVT	CURRENT ALTITUDE	ALTIME1
T/C	TCVT	CURRENT SPEED (MACH NUMBER)	TIMACH1
NUMBER OF FUSELAGES	NFUSE	DISTANCE TRAVELED SOFAR	DIST1
TOTAL LENGTH	XL	CURRENT AIRCRAFT GROSS WGHT	GWTIME1
MAXIMUM WIDTH	WF	AMOUNT OF FUEL CONSUMED	FUELTI1
MAXIMUM DEPTH	DF	CURRENT ENGINE THRUST	THRSTI1
CARGO AIRCRAFT FACTOR	CARGF	FLOPS SPECIFIC FUEL CONSUM.	SFCFL1
PASSENGER COMPART LENGTH	XLP	CURRENT FUEL FLOW RATE	FLOWFL1
LENGTH OF MAIN GEAR	XMLG	TIME SINCE TAKEOFF	TIME2
LENGTH OF NOSE GEAR	XNLG	CURRENT ALTITUDE	ALTIME2
CARRIER BASED AIRCRAFT	CARBAS	CURRENT SPEED (MACH NUMBER)	TIMACH2
NUMBER OF ENGINES ON WING	NEW	DISTANCE TRAVELED SOFAR	DIST2
NUMBER OF ENGINES ON FUSE	NEF	CURRENT AIRCRAFT GROSS WGHT	GWTIME2
BASELINE ENGINE THRUST	THRSO	AMOUNT OF FUEL CONSUMED	FUELTI2
BASELINE ENGINE WEIGHT	WENG	CURRENT ENGINE THRUST	THRSTI2
WEIGHT SCALING PARAMETER	EEXP	FLOPS SPECIFIC FUEL CONSUM.	SFCFL2
BASELINE NACELLE LENGTH	XNAC	CURRENT FUEL FLOW RATE	FLOWFL2
BASELINE NACELLE DIAMETER	DNAC	TIME SINCE TAKEOFF	TIME3
FUEL CAPACITY OF WING	FULWMX	CURRENT ALTITUDE	ALTIME3
FUEL CAPACITY OF FUSELAGE	FULFMX	CURRENT SPEED (MACH NUMBER)	TIMACH3
AUX. TANK FUEL CAPACITY	FULAUX	DISTANCE TRAVELED SOFAR	DIST3
NUMBER OF FUEL TANKS	NTANK	CURRENT AIRCRAFT GROSS WGHT	GWTIME3
ADDED MISC PROP SYSTEM WT	WPMISC	AMOUNT OF FUEL CONSUMED	FUELTI3
FIRST CLASS PASSENGERS	NPF	CURRENT ENGINE THRUST	THRSTI3
TOURIST PASSENGERS	NPT	FLOPS SPECIFIC FUEL CONSUM.	SFCFL3
STEWARDESSES	NSTU	CURRENT FUEL FLOW RATE	FLOWFL3
GALLEY CREW	NGALC	FLOPS AIRCRAFT GROSS WEIGHT	GWFLTO
FLIGHT CREW	NFLCR	FLOPS DESIGN MACH NUMBER	DESMAC
WEIGHT PER PASSENGER	WPPASS	FLOPS CRUISE VELOCITY	VFLOPS
BAGGAGE PER PASSENGER	BPP	FLOPS MAX. DYNAMIC PRESSURE	PRESSF
THRUST REVERSERS - TOTAL	WTHR	FLOPS TOTAL RANGE	RGFLTO
DESIGN RANGE	DESRNG	FLOPS BLOCK TIME	BTIMFL
WING LOADING REQUIRED	WSR	FLOPS BLOCK FUEL	BFUELF
THRUST/WEIGHT REQUIRED	TWR	FLOPS WING WEIGHT	WINWGFL
HORIZ TAIL VOLUME COEF	HTVC	FLOPS WING COST	WINCOFL
VERT TAIL VOLUME COEF	VTVC	FLOPS TAIL WEIGHT	TAIWGFL
RAMP WEIGHT	GWFLOPS	FLOPS TAIL COST	TAICOFL
WING ASPECT RATIO	ARFLOPS	FLOPS FUSELAGE WEIGHT	FUSWGFL
WING TAPER RATIO	TRFLOPS	FLOPS FUSELAGE COST	FUSCOFL
WING 1/4 CHORD SWEEP	SWEEP	FLOPS LANDING GEAR WEIGHT	LANWGFL
WING THICKNESS-CHORD RATIO	TCA	FLOPS LANDING GEAR COST	LANCOFL

Input Parameters (Continued)		Output Parameters (Continued)	
CRUISE MACH NUMBER	VCMN	FLOPS NACELLE WEIGHT	NACWGFL
MAX CRUISE ALTITUDE	CH	FLOPS NACELLE COST	NACCOFL
OBJ. FUN. WEIGHTING FACTOR	OFG	FLOPS THRUST REVERSER WGHT	THRWGFL
OBJ. FUN. WEIGHTING FACTOR	OFF	FLOPS THRUST REVERSER COST	THRCOFL
OBJ. FUN. WEIGHTING FACTOR	OFC	FLOPS SURFACE CONTROL WGHT	SURWGFL
WING TECHNOLOGY	AITEK	FLOPS SURFACE CONTROL COST	SURCOFL
FIXED DESIGN LIFT COEFFIC.	FCLDES	FLOPS AUX POWER UNIT WEIGHT	AUXWGFL
TURBULENT/LAMINAR FLOW	XLLAM	FLOPS AUX POWER UNIT COST	AUXCOFL
MAX. LANDING/TAKEOFF WEIGHT	WRATIO	FLOPS INSTRUMENTS WEIGHT	INSWGFL
MAX. LANDING VELOCITY	VAPPR	FLOPS INSTRUMENTS COST	INSCOFL
MAX. TAKEOFF FIELD LENGTH	FLTO	FLOPS HYDRAULICS WEIGHT	HYDWGFL
MAX. LANDING FIELD LENGTH	FLLDG	FLOPS HYDRAULICS COST	HYDCOFL
MAX. CL TAKEOFF CONFIG.	CLTOM	FLOPS ELECTRICAL WEIGHT	ELEWGFL
MAX. CL LANDING CONFIG.	CLLDM	FLOPS ELECTRICAL COST	ELECOFL
AIR DENSITY RATIO	DRATIO	FLOPS AVIONICS WEIGHT	AVIWGFL
FLIGHT IDLE SWITCH	IDLE	FLOPS AVIONICS COST	AVICOFL
INDICATOR OF ENGINE DECK	IGENEN	FLOPS FURNISHING WEIGHT	FURWGFL
MIN IDLE FUEL FLOW FRACT	FIDMIN	FLOPS FURNISHING COST	FURCOFL
MAX IDLE FUEL FLOW FRACT	FIDMAX	FLOPS AIR CONDITION. WEIGHT	AIRWGFL
ENGINE DECK FILE NAME	EIFILE	FLOPS AIR CONDITION. COST	AIRCOFL
PRINT MISSION CONTROL	IFLAG	FLOPS ANTI-ICING WEIGHT	ICEWGFL
DETAILED MISSION PRINT	MSUMPT	FLOPS ANTI-ICING COST	ICECOFL
FLAG FOR RAMP WEIGHT ESTIM.	IRW	FLOPS PNEUMATIC WEIGHT	PNEWGFL
FUEL FLOW FACTOR	FACT	FLOPS PNEUMATIC COST	PNECOFL
CDO FACTOR	FCDO	FLOPS EMPTY WEIGHT	EMPWGFL
CDI FACTOR	FCDI	FLOPS TOTAL AIRFRAME COST	AIRTCOS
OWE FACTOR	OWFACT	FLOPS AIRFRAME R&D COST	RADCOST
RANGE TOLERANCE	RTOL	AIRFRAME INSPECT.MATERIAL	AIRMAT
ATA TRAFFIC ALLOWANCE	IATA	AIRFRAME INSPECT.LABOR	AIRLAB
WEIGHT INCREMENT	DWT	AIR CONDITIONING MATERIAL	ACMAT
TAKEOFF TIME	TAKOTM	AIR CONDITIONING LABOR	ACLAB
TAXI-OUT TIME	TAXOTM	AUTOPILOT MATERIAL COST	AUTMAT
TAXI-IN TIME	TAXITM	AUTOPILOT LABOR COST	AUTLAB
TAKEOFF POWER SETTING	ITTFF	COMMUNICATIONS MATERIAL	COMMAT
MINIMUM CLIMB MACH NUMBER	CLMMIN	COMMUNICATIONS LABOR COST	COMLAB
MINIMUM CLIMB ALTITUDE	CLAMIN	ELECTRICAL POWER MATERIAL	ELEMAT
NUMBER OF CLIMB STEPS	NINCL	ELECTRICAL POWER LABOR COST	ELELAB
CLIMB OPTIMIZATION FACTOR	FWF	EQUIPMENT & FURNISHINGS MAT	EQUMAT
CRUISE OPTION SWITCH	IOC	EQUIPMENT & FURNISHINGS LAB	EQULAB
MINIMUM MACH NUMBER	CRMMIN	FIRE PROTECTION MATERIAL	FIRMAT
MINIMUM DESCENT ALTITUDE	DEAMIN	FIRE PROTECTION LABOR	FIRLAB
MISSED APPROACH TIME	TIMMAP	FLIGHT CONTROLS MATERIAL	FLIMAT
RESERVE HOLDING TIME	HOLDTM	FLIGHT CONTROLS LABOR	FLILAB
2ND RES HOLD TIME OR FRAC	THOLD	FUEL MATERIAL	FUEMAT
NUMBER OF DESCENT STEPS	NINDE	FUEL LABOR	FUELAB
MINIMUM DESCENT MACH NO.	DEMMIN	HYDRAULIC POWER MATERIAL	HYDMAT
WEIGHT COMPUTATION OPTION	MYWTS	HYDRAULIC POWER LABOR	HYDLAB
DESIGN RANGE	DESRNG2	ICE AND RAIN PROTECTION MAT	ICEMAT
REQUIRED WING LOADING	WSR2	ICE AND RAIN PROTECTION LAB	ICELAB
REQUIRED THRUST/WEIGHT	TWR2	INSTRUMENTS MATERIAL	INSMAT
TYPE OF COST CALCULATION	ICOSTP	INSTRUMENTS LABOR	INSLAB
R&D SWITCH	IRAD	LANDING GEAR MATERIAL	LANMAT
YEAR FOR CALCULATIONS	DYEAR	LANDING GEAR LABOR	LANLAB
DEVELOPMENT START TIME	DEVST	LIGHTING MATERIAL	LIGMAT
FAA CERTIFICATION DATE	PLMQT	LIGHTING LABOR	LIGLAB
SPARES FACTOR FOR AIRFRAME	FAFMSP	NAVIGATION MATERIAL	NAVMAT
SPARES FACTOR FOR ENGINES	FENGSP	NAVIGATION LABOR	NAVLAB
AIRFRAME PRODUCTION QUANT.	Q	OXYGEN MATERIAL	OXYMAT
NO OF PROTOTYPE AIRCRAFT	NPROTP	OXYGEN LABOR	OXYLAB

Input Parameters (Continued)	
NO OF FLIGHT TEST AIRCRAFT	NFLTST
SPARES FACTOR FOR DEVELOP.	FPPFT
ENGINE PRESSURE RATIO	EPR
FLOPS ENGINE DESIGN SFC	FLSFC
MAX TURBINE INLET TEMP	TEMPTUR
BODY TYPE SWITCH	IBODY
CIRCUIT INDICATOR	ICIRC
AC TOTAL PACK FLOW	AC
APU FLOW RATE	APUFLW
APU SHAFT HORSEPOWER	APUSHP
HYDRAULIC PUMP FLOW RATE	HYDGPM
KVA RATING OF FULLTIME GENS	KVA
NO OF APUS	NAPU
NO OF AUTOPILOT CHANNELS	NCHAN
NO OF INFLIGHTOPERATED GENS	NGEN
MANUFACTURERS PROFIT RATE	PRORAT
DEPRECIATION PERIOD	DEPPER
FARE	FARE
FUEL PRICE	FUELPR
TAX RATE FOR ROI CALCUL.	TAXRAT
NO OF PODDED ENGINES	NPOD
DIRECT LABOR BURDEN FACTOR	DLBUR
NO OF YEARS FOR LCC CALCUL.	LIFE
RESIDUAL AT END OF DEPPER	RESID
RETURN ON INVESTMENT	ROI
LOAD FACTOR	LF
% OF SEATS FOR 1ST CLASS	PCTFC
MULTIPLEX INDICATOR	IMUX
AUXILIARY POWER INDICATOR	ISPOOL
AIRCRAFT GROSS WEIGHT	GW
WEIGHT of BARE ENGINE	EN
ESTIMATED TOTAL LENGTH	TLEN
ESTIMATED MAXIMUM RADIUS	RADMAX
NUMBER OF ENGINES	NE
CRUISE ALTITUDE	ALT
CRUISE SPEED	VC
CRUISE THRUST	ATC
RANGE	RANGE

Output Parameters (Continued)	
PNEUMATICS MATERIAL	PNEMAT
PNEUMATICS GEAR LABOR	PNELAB
WATER/WASTE MATERIAL COST	WATMAT
WATER/WASTE LABOR COST	WATLAB
AIRBORNE AUXIL. POWER MAT.	AUXMAT
AIRBORNE AUXIL. POWER LABOR	AUXLAB
STRUCTURES MATERIAL COST	STRMAT
STRUCTURES LABOR COST	STRLAB
DOORS MATERIAL COST	DORMAT
DOORS LABOR COST	DORLAB
FUSELAGE MATERIAL COST	FUSMAT
FUSELAGE LABOR COST	FUSLAB
NACELLES MATERIAL COST	NACMAT
NACELLES LABOR COST	NACLAB
STABILIZERS MATERIAL COST	STAMAT
STABILIZERS LABOR COST	STALAB
WINDOWS MATERIAL COST	WINMAT
WINDOWS LABOR COST	WINLAB
WINGS MATERIAL COST	WIGMAT
WINGS LABOR COST	WIGLAB
AIRFRAME MAINTENANCE MAT.	AFRMAT
AIRFRAME MAINTENANCE LABOR	AFRLAB
PROPULSION SYSTEM MAINT.MAT	PROMAT
PROPULSION SYSTEM MAINT.LAB	PROLAB
MATERIAL COST SUBTOTAL	SUBMAT
DIRECT LABOR SUBTOTAL	SUBLAB
MAINTENANCE LABOR BURDEN	BURLAB
TOTAL MAINTENANCE/DEPARTURE	MAICOS
DEPRECIATION COST	DEPCOS
INSURANCE COST	RCECOS
AIRCRAFT SERVICING COST	SERCOS
FLIGHT CREW COST	CRECOS
FUEL COST	FUECOS
LIFETIME DOC COST	LIFCOS
GROUND PROPERTY/EQUIP. COST	GROCOS
CABIN CREW EXPENSES COST	CABCOS
PASSENGER FOOD & BEVERAGE	FABCOS
PASS. SERVICE SUPPORT COST	SUPCOS
AIRCRAFT CONTROL COST	CONCOS
PASSENGER HANDLING, RESERV.	HANCOS
BAGGAGE HANDLING COST	BAGCOS
CARGO HANDLING COST	CARCOS
FREIGHT SALES COST	SALCOS
GENERAL/ADMINISTRATIVE COST	ADMCOS
TOTAL INDIRECT OPERATING	INDCOS
FLOPS MANUFACTURING COST	MANCOS
AIRFRAME SPARES COST	SPACOS
ENGINES SPARES COST	SPECOS
MANUFACTURERS PROFIT	MANPRO
TOTAL ACQUISITION COST	ACQCOS
TOTAL LIFE DOC	DOCLIF
TOTAL LIFE INDIRECT OC	IOCLIF
TOTAL LIFE CYCLE COST	CYCCOS
TOTAL LIFE OPERATING COST	OPECOS
RETURN ON INVESTMENT	ROIPER
FARE COST	FARCOS

The time-dependent mission output parameters obtained from the FLOPS module are:

- segment 1 climb detailed data: TIME1, ALTIME1, TIMACH1, DIST1, GWTIME1, FUELTI1, THRSTI1, SFCFL1, and FLOWFL1

- segment 2 cruise detailed data: TIME2, ALTIME2, TIMACH2, DIST2, GWTIME2, FUELTI2, THRSTI2, SFCFL2, and FLOWFL2

- segment 3 descent detailed data: TIME3, ALTIME3, TIMACH3, DIST3, GWTIME3, FUELTI3, THRSTI3, SFCFL3, and FLOWFL3

APPENDIX D

T/BEST EXECUTIVE SYSTEM MISCELLANEOUS DATA

D.1 Listing of the T/BEST UNIX Shell *tbest.exe*

The T/BEST shell script, tbest.exe, used to manage and control the execution of T/BEST analyses modules is listed here:

```
base="`pwd`";
cd $base;
bold=`tput smso`;
unbold=`tput rmso`;
suf='input';
clear;
echo;
echo;
echo;
echo "  TTTTTTTTTTTT       //  BBBBBBBBBBB   EEEEEEEEEEEE   SSSSSSSSSS   TTTTTTTTTTTT";
echo "  TTTTTTTTTTTT      //   BBBBBBBBBBBB  EEEEEEEEEEEE  SSSSSSSSSSSS  TTTTTTTTTTTT";
echo "       TT           //   BB        BB  EE            SS        SS       TT";
echo "       TT          //    BB        BB  EE            SS                 TT";
echo "       TT          //    BB       BB   EE            SSS                TT";
echo "       TT         //     BBBBBBBBBB    EEEEEEEE       SSSSSSSSS         TT";
echo "       TT         //     BBBBBBBBBB    EEEEEEEE        SSSSSSSSS        TT";
echo "       TT        //      BB       BB   EE                     SSS       TT";
echo "       TT        //      BB        BB  EE                      SS       TT";
echo "       TT       //       BB        BB  EE            SS        SS       TT";
echo "       TT       //       BBBBBBBBBBBB  EEEEEEEEEEEE  SSSSSSSSSSSS       TT";
echo "       TT      //        BBBBBBBBBBB   EEEEEEEEEEEE   SSSSSSSSSS        TT";
echo;
echo;
echo "                       ${bold}T${unbold}echnology ${bold}B${unbold}enefit
${bold}EST${unbold}imator";
echo;
echo "  $LOGNAME\c";
tput cup 19 70;
date +"%D";
name=`grep $LOGNAME /etc/passwd | cut -d: -f5`;
echo "  $name\c";
tput cup 20 70;
date +"%T";
echo;
echo " Press <return> to continue . . . or press h for help . . .  ";
read junk;
#
# if user responds with an 'h', present the help menus.
#
if [ $junk -a $junk = 'h' ] ; then
   cd ${base}/help
   help_tbest
   cd ${base}
   fi;
# go to graphics directory and check the need to compile and link the
# graphic code
cd ${base}/exe/graphexe
    check1='pchart.exe'
    check2='bchart.exe'
clear;
   if [  -x $check1 ] ; then :
     else
    cd ${base}/src/graphsrc
   tput cup 11 10;
   echo " Compiling/Linking ${bold}piechart${unbold} graphic module";
    f77 -c  pchart.f
    cc  -c  piechart.c
    f77 -o  pchart.exe pchart.o piechart.o -lgl_s >/dev/null
    mv pchart.exe  ${base}/exe/graphexe/pchart.exe
    /bin/rm pchart.o piechart.o
    cd ${base}/exe/graphexe
   fi;
   if [  -x $check2 ] ; then :
     else
```

```
     cd ${base}/src/graphsrc
    tput cup 14 10;
     echo " Compiling and Linking ${bold}barchart${unbold} graphic module";
     f77 -c  bchart.f
     cc  -c  barchart.c
     f77 -o  bchart.exe bchart.o barchart.o -lgl_s > /dev/null
     mv bchart.exe  ${base}/exe/graphexe/bchart.exe
     /bin/rm bchart.o barchart.o
    fi;
#
# check if flops.exe is present if not then compile and link
# the modules that make-up the flops executable
#
clear;
cd ${base}/exe/flops
     check3='flops.exe'
    if [  -x $check3 ] ; then :
      else
     cd ${base}/src/flops
# shell script to compile and link the flops module
    tput cup 11 10;
    echo " Compiling/Linking ${bold}flops${unbold} modules";
f77 -c -static sfaero.f
f77 -c -static sfcost.f
f77 -c -static sfcycl.f
f77 -c -static sfeng.f
f77 -c -static sffoot.f
f77 -c -static sfmain.f
f77 -c -static sfperf.f
f77 -c -static sftol.f
f77 -c -static sfwate.f
f77 -c -static smacyc.f
f77 -c -static smatol.f
f77 -o flops.exe sfaero.o sfcost.o sfcycl.o sfeng.o sffoot.o sfmain.o sfperf.o sftol.o
sfwate.o smacyc.o smatol.o
/bin/rm s*.o
mv flops.exe ${base}/exe/flops/flops.exe
    fi;
    cd ${base}
#
# read a list of all executables and check to see if they exist in their
# appropriate locations, if not check for the source under the src directory
# and compile it with the -static option, output going to the appropriate
# output directory.
#
exec < ${base}/list.exefiles;
while read exes; do
clear;
   if [ ! -x ${base}/$exes ] ; then
      sources=`basename $exes .exe`;
      if [ -r ${base}/src/$sources.f ] ; then
   tput cup 11 10;
   echo " Compiling/Linking ${bold}$sources${unbold} module";
         f77 -static -o ${base}/$exes ${base}/src/$sources.f;
      else
         echo " \07\07Unable to locate source file for $sources";
         exit;
         fi;
      fi;
   done;
clear;
exec < /dev/tty;
cd ${base}/out;
  /bin/rm -f M*.OUT B*.OUT nnepwate.out fort.*;
cd ${base}/in;
#
   /bin/rm -f FCR RANGE blade.order neutral.updated scratch* fort.*;
   /bin/rm -f B*.INP B*.OUT M*.INP M*.OUT;
   /bin/rm -f ${base}/wrk/*.scratch;
# execute here the code neutgen to generate the neutral.file
#
#
# Show that neutgen is being executed and wait for user to respond to continue.
#
cp ${base}/airfoil.bank airfoil.bank;
cp ${base}/databk.data .;
   clear;
   tput cup 9 27;
   echo " Executing ${bold}neutgen${unbold}";
   tput cup 11 10;
```

```
    echo " Generating neutral file for T/BEST";
    tput cup 13 10;
    echo " INPUT: neutral.file ${bold}default${unbold} parameters";
    tput cup 15 10;
    echo " OUTPUT:${bold}$base/in/neutral.file${unbold}";
    tput cup 18 10;
    echo "  Press <return> to continue . . . \c";
    read junk;
   clear;
  ${base}/exe/misc/neutgen.exe;
    clear;
#
# Decide the name of the input file.
#
infile=`/bin/ls -Ct *.input 2> /dev/null`;
inum=`echo $infile | awk ' { print NF } '`;
infile=`expr \`echo $infile | awk ' {print $1} '\` : "\(.*\).$suf"`;
#
# if there is more than one input file, give the user the option to choose
# which one he/she wishes to use.
#
if [ $inum -gt 1 ] ; then
   clear;
   tput cup 11 20;
   echo "T/BEST has chosen ${bold}$infile${unbold} as its input";
   tput cup 13 5;
   echo "Would you like to use a different input file? (Y/N) \c";
   read junk;
   if [ "$junk" ] ; then :
   else
      junk='N';
      fi;
   if [ `echo $junk | tr '[a-z]' '[A-Z]'` = 'Y' ] ; then
      while true; do
         clear;
         tput cup 11 25;
         echo "Your choices are as follows:\n";
         /bin/ls -CF *.input;
         echo "\nWhich file do you wish to choose? \c";
         read junk;
         if [ "$junk" ] ; then
            pre=`expr $junk : '\(.*\)\.'`;
            post=`expr $junk : '.*\.\(.*\)'`;
            if [ $post ] ; then
               if [ "$post" != "input" ] ; then
                  echo "The input file must have an extension of \c";
                  echo "${bold}input${unbold}";
                  echo "\nPress <return> to continue . . . \c";
                  read junk;
                  continue;
               else
                  thefile=$pre.$post;
                  if [ -f $thefile ] ; then
                     infile=`expr \`echo $thefile\` : '\(.*\).input'`;
                     break;
                  else
                     echo "$thefile: does not exist";
                     echo "\nPress <return> to continue . . . \c";
                     read junk;
                     continue;
                     fi;
                  fi;
            elif [ -f $junk.input ] ; then
               infile=$junk;
               break;
            else
               echo "$junk.input: does not exist";
               echo "\nPress <return> to continue . . . \c";
               read junk;
               continue;
               fi;
            fi;
         done;
      fi;
   fi;
#
# Enter into an infinite loop such that if the appropriate conditions exist,
# the code will re-run nnepwate.
#
#  while true; do
```

```
#
# if the matching maps file does not exist for the given input file, exit.
#
   if [ -f $infile.maps ] ; then :
   else
      echo "File: $infile.maps does not exist";
      exit;
      fi;
#
# Generate the input responses to nnepwate.
#
   cd ${base}/wrk;
   echo $infile > nnepwate.in;
   echo " " >> nnepwate.in;
   echo "$base/out/$infile.output" >> nnepwate.in;
#
# Present the screen which informs the user that NNEP/WATE is being executed.
#
   cp ${base}/in/$infile.input .;
   cp ${base}/in/$infile.maps .;
   clear;
   tput cup 9 27;
   echo "Executing ${bold}nnepwate${unbold}";
   tput cup 11 10;
   echo "Engine cycle and weight analyses"
   tput cup 13 10;
   echo "INPUT: ${bold}$base/in/$infile.input${unbold}";
   tput cup 15 10;
   echo "OUTPUT: ${bold}$base/out/$infile.output${unbold}";
   tput cup 24 1;
${base}/exe/nnepwate/nnepwate.exe< nnepwate.in >>${base}/wrk/nnep.scratch 2>&1;
   cd ${base}/in;
   cp ${base}/out/$infile.output ./nnepwate.out;
#
# Show that nneppost is being executed and wait for user to respond to continue.
#
   clear;
   tput cup 9 27;
   echo " Executing ${bold}nneppost${unbold}";
   tput cup 11 10;
   echo " Post-Processing nnepwate output";
   tput cup 13 10;
   echo " INPUT: ${bold}$base/out/$infile.output${unbold}";
   tput cup 15 10;
   echo " OUTPUT:${bold}$base/in/neutral.file${unbold}";
   /bin/rm -f neutral.updated scratch* fort.*;
 ${base}/exe/misc/nneppost.exe;
   tput cup 18 10;
   echo "  Press <return> to continue . . . \c";
   read junk;
   clear;
#
# Generate blasim input files
#
   tput cup 9 27;
   echo " Executing ${bold}blasimgen${unbold}";
   tput cup 11 10;
   echo " Generating blasim input files for all stages";
   tput cup 12 10;
   echo " of each fan, compressor, and turbine";
   tput cup 14 10;
   echo " INPUT:  ${bold}neutral.file${unbold}";
   tput cup 16 10;
   echo " OUTPUT: ${bold}blasim${unbold} input files";
   ${base}/exe/misc/blasimgen.exe;
   /bin/rm -f neutral.updated;
   tput cup 19 10;
   echo "  Press <return> to continue . . . \c";
   read junk;
   clear;
#
# Generate the names of the input files for blasim, generate a listing
# of these files in numerical order in the file blade.order.
#
   inputs=`echo B*.INP`;
   /bin/ls B*.INP | sort +0.4 > blade.order;
#
# Define a looping mechanism which runs each generated input file in
# blasim and moves the output to the tbest directory.
#
```

```
 cp ${base}/databk.data fort.8;
    for i in $inputs; do
       pre=`expr "$i" : '\(.*\).INP'`;
       cp $pre.INP fort.25;
       clear;
       tput cup 9 21;
       echo "BLASIM is processing ${bold}$pre.INP${unbold} ";
       title=`awk ' NR == 1 { print $0 } ' $pre.INP`;
#      col=`awk ' NR == 1 { printf("%d",length($0)) } ' $pre.INP`;
#      col=`expr \`expr 80 - $col\` / 2`;
#      tput cup 11 $col;
#      tput cup 11 1;
#      echo $title;
       tput cup 11 10;
       echo "Blade structural analysis";
       tput cup 13 10;
       echo "INPUT: ${bold}${base}/in/$pre.INP${unbold}";
       tput cup 15 10;
       echo "OUTPUT: ${bold}${base}/out/$pre.OUT${unbold}";
       tput cup 24 1;
       ${base}/exe/blasim/blasim.exe > blasim.out;
       ${base}/exe/misc/blasimsr.exe ;
       cat root.static >> tempo
       cp fort.30 $pre.OUT;
       mv fort.30 ${base}/out/$pre.OUT;
       /bin/rm -f fort.* blasim.out junk*;
       done;
    mv tempo root.static;
#
# execute blasimpost.exe executable.
#
    clear;
    tput cup 9 27;
    echo " Executing ${bold}blasimpost${unbold}";
    tput cup 11 10;
    echo " Update neutral file to include structural response parameters";
    tput cup 13 10;
    echo " INPUT:  ${bold}blasim${unbold} output files";
    tput cup 15 10;
    echo " OUTPUT: ${bold}neutral.file${unbold}";
    ${base}/exe/misc/blasimpost.exe;
    tput cup 18 10;
    echo "  Press <return> to continue . . . \c";
    mv root.static ${base}/out/root.static;
    read junk;
    /bin/rm -f neutral.updated B*.OUT fort.*;
####
# Run the mtsbgen.exe executable.
#
    clear;
    tput cup 9 27;
    echo " Executing ${bold}mtsbgen${unbold}";
    tput cup 11 10;
    echo " Generating mtsb input files for all stages";
    tput cup 12 10;
    echo " of each fan, compressor, and turbine";
    tput cup 14 10;
    echo " INPUT:  ${bold}neutral.file${unbold}";
    tput cup 16 10;
    echo " OUTPUT: ${bold}mtsb${unbold} input files";
    ${base}/exe/misc/mtsbgen.exe;
    /bin/rm -f neutral.updated;
    tput cup 19 10;
    echo "  Press <return> to continue . . . \c";
    read junk;
    clear;
#
# Define a looping mechanism which runs each generated input file in
# mtsb and moves the output to the out directory.
#
  inputs=`echo M*.INP`;
  for i in $inputs; do
     pre=`expr "$i" : '\(.*\).INP'`;
     cp $pre.INP fort.33;
     clear;
     tput cup 9 21;
     echo "MTSB is processing ${bold}$pre.INP${unbold} ";
     tput cup 11 10;
     echo "Transonic flow analysis";
     tput cup 13 10;
```

```
    echo "INPUT: ${bold}${base}/in/$pre.INP${unbold}";
    tput cup 15 10;
    echo "OUTPUT: ${bold}${base}/out/$pre.OUT${unbold}";
    tput cup 24 1;
    ${base}/exe/mtsb/mtsb.exe > out;
    cp fort.26 $pre.OUT;
    mv fort.26 ${base}/out/$pre.OUT;
    /bin/rm -f fort.* out;
    done;

#
# Run the mtsbpost.exe executable.
#
    clear;
  tput cup 9 27;
  echo " Executing ${bold}mtsbpost${unbold}";
  tput cup 11 10;
  echo " Update neutral file to include output parameters form mtsb";
  tput cup 13 10;
  echo " INPUT:  ${bold}mtsb${unbold} output files";
  tput cup 15 10;
  echo " OUTPUT: ${bold}neutral.file${unbold}";
  ${base}/exe/misc/mtsbpost.exe;
  /bin/rm -f   neutral.updated M*.OUT;
  tput cup 18 10;
  echo "  Press <return> to continue . . . \c";
  read junk;
  clear;
  /bin/rm -f neutral.updated;
#
# Run noise.exe executable.
#
  tput cup 9 27;
  echo " Executing ${bold}noise${unbold}";
  tput cup 11 10;
  echo " Estimates fan tone, broad band and noise jet";
  tput cup 12 10;
  echo " Update neutral file";
  tput cup 14 10;
  echo " INPUT:  ${bold}neutral.file${unbold}";
  tput cup 16 10;
  echo " OUTPUT: ${bold} updated neutral.file${unbold}";
  ${base}/exe/misc/noise.exe>>${base}/wrk/noise.scratch;
  cat fort.61 >> noise.scratch;
  mv noise.scratch ${base}/wrk/noise.scratch2;
  tput cup 19 10;
  echo "  Press <return> to continue . . . \c";
  read junk;.
  /bin/rm -f neutral.updated;
#
# if the file GW exists, run predtbest
#
  if [ -f GW ] ; then
  clear;
  tput cup 9 27;
  echo " Executing ${bold}predict${unbold}";
  tput cup 11 10;
  echo " Predicts gross, airframe, engine, capacity and fuel weights"
  tput cup 12 10;
  echo " Update neutral file ";
  tput cup 14 10;
  echo " INPUT:  ${bold}neutral.file${unbold}";
  tput cup 16 10;
  echo " OUTPUT: ${bold} updated neutral.file${unbold}";
     ${base}/exe/misc/predict.exe>>${base}/wrk/predict.scratch;
  tput cup 19 10;
  echo "  Press <return> to continue . . . \c";
  read junk;
     /bin/rm -f neutral.updated;
     fi;
#
# if the file AW exists, run predict (tbest)
#
  if [ -f AW ] ; then
  tput cup 9 27;
  echo " Executing ${bold}predict${unbold}";
  tput cup 11 10;
  echo " Predicts gross, airframe, engine, capacity and fuel weights"
  tput cup 12 10;
  echo " Update neutral file ";
```

```
    tput cup 14 10;
    echo " INPUT:  ${bold}neutral.file${unbold}";
    tput cup 16 10;
    echo " OUTPUT: ${bold} updated neutral.file${unbold}";
    ${base}/exe/misc/predict.exe>>${base}/wrk/predict.scratch;
    tput cup 19 10;
    echo "  Press <return> to continue . . . \c";
    read junk;
    clear;
       /bin/rm -f neutral.updated;
       fi;
#
# if the file EN exists, loop back to the beginning again
#
    if [ -f EN ] ; then
       /bin/rm -f neutral.updated;
       continue;
       fi;
#
# if the file FW and FCR exists, run predict (predtbest)
#
    if [ -f FW -a -f FCR ] ; then
    clear;
    tput cup 9 27;
    echo " Executing ${bold}predict${unbold}";
    tput cup 11 10;
    echo " Predicts gross, airframe, engine, capacity and fuel weights"
    tput cup 12 10;
    echo " Update neutral file ";
    tput cup 14 10;
    echo " INPUT:  ${bold}neutral.file${unbold}";
    tput cup 16 10;
    echo " OUTPUT: ${bold} updated neutral.file${unbold}";
       ${base}/exe/misc/predict.exe>>${base}/wrk/predict.scratch;
    tput cup 19 10;
    echo "  Press <return> to continue . . . \c";
    read junk;
       /bin/rm -f neutral.updated;
       fi;
#
# if the file RANGE exists, run rantbest
#
    if [ -f RANGE ] ; then
    clear;
    tput cup 9 27;
    echo " Executing ${bold}range${unbold}";
    tput cup 11 10;
    echo " Estimates the BREGUET cruise-climb range"
    tput cup 12 10;
    echo " Update neutral file ";
    tput cup 14 10;
    echo " INPUT:  ${bold}neutral.file${unbold}";
    tput cup 16 10;
    echo " OUTPUT: ${bold} updated neutral.file${unbold}";
       ${base}/exe/misc/range.exe>>${base}/wrk/range.scratch;
    tput cup 19 10;
    echo "  Press <return> to continue . . . \c";
    read junk;
       /bin/rm -f neutral.updated;
       fi;
#
# Run citytbest
#
    clear;
    tput cup 9 27;
    echo " Executing ${bold}city${unbold}";
    tput cup 11 10;
    echo " Determines number of city pairs in U.S. and Western Europe"
    tput cup 12 10;
    echo " Update neutral file ";
    tput cup 14 10;
    echo " INPUT:  ${bold}neutral.file${unbold}";
    tput cup 16 10;
    echo " OUTPUT: ${bold} updated neutral.file${unbold}";
       ${base}/exe/misc/city.exe>>${base}/wrk/city.scratch;
    tput cup 19 10;
    echo "  Press <return> to continue . . . \c";
    read junk;
       /bin/rm -f neutral.updated;
#
```

```
# Run repair (formerly engtbest)
#
   clear;
   tput cup 9 27;
   echo " Executing ${bold}repair${unbold}";
   tput cup 11 10;
   echo " Estimates mean time between engine repair and material/labor"
   tput cup 12 10;
   echo " Update neutral file ";
   tput cup 14 10;
   echo " INPUT:  ${bold}neutral.file${unbold}";
   tput cup 16 10;
   echo " OUTPUT: ${bold} updated neutral.file${unbold}";
      ${base}/exe/misc/repair.exe>>${base}/wrk/repair.scratch;
   tput cup 19 10;
   echo "  Press <return> to continue . . . \c";
   read junk;
      /bin/rm -f neutral.updated;
#
# Run doc
#
   clear;
   tput cup 9 27;
   echo " Executing ${bold}doc${unbold}";
   tput cup 11 10;
   echo " Predicts direct operating cost of airframe and engines"
   tput cup 12 10;
   echo " Update neutral file ";
   tput cup 14 10;
   echo " INPUT:  ${bold}neutral.file${unbold}";
   tput cup 16 10;
   echo " OUTPUT: ${bold} updated neutral.file${unbold}";
      ${base}/exe/misc/doc.exe>>${base}/wrk/doc.scratch;
   tput cup 19 10;
   echo "  Press <return> to continue . . . \c";
   read junk;
      /bin/rm -f neutral.updated;
#
# Run lcc (formerly servtbest)
#
   clear;
   tput cup 9 27;
   echo " Executing ${bold}lcc${unbold}";
   tput cup 11 10;
   echo " Predicts engine maintenance cost for a given year of service"
   tput cup 12 10;
   echo " Update neutral file ";
   tput cup 14 10;
   echo " INPUT:  ${bold}neutral.file${unbold}";
   tput cup 16 10;
   echo " OUTPUT: ${bold} updated neutral.file${unbold}";
   ${base}/exe/misc/lcc.exe>>${base}/wrk/lcc.scratch;
   tput cup 19 10;
   echo "  Press <return> to continue . . . \c";
   read junk;
   clear;
   /bin/rm -f neutral.updated scratch* fort.*;

#
# generate flops input file
#
   tput cup 9 27;
   echo " Executing ${bold}flopsgen${unbold}";
   tput cup 11 10;
   echo " Generating flops input file";
   tput cup 14 10;
   echo " INPUT:  ${bold}neutral.file${unbold}";
   tput cup 16 10;
   echo " OUTPUT: ${bold}flopsin.file${unbold}";
   ${base}/exe/misc/flopsgen.exe;
   /bin/rm -f neutral.updated;
   tput cup 19 10;
   echo "  Press <return> to continue . . . \c";
   read junk;
   clear;
#
# Run flops (flight optimization system)
#
   clear;
   tput cup 6 27;
```

```
    echo " Executing ${bold}flops${unbold}";
    tput cup  8 10;
    echo " Flight Optimization System (mission/cost analyses)"
    tput cup 10 10;
    echo " INPUT:  ${bold}flopsin.file${unbold}";
    tput cup 11 10;
    echo "          file renamed $infile.flopsin";
    tput cup 13 10;
    echo " OUTPUT: ${bold}flopsout.file${unbold}";
    tput cup 14 10;
    echo "          file renamed $infile.flopsout";
    tput cup 16 10;
    echo " ";
    ${base}/exe/flops/flops.exe <flopsin.file> flopsout.file;
    tput cup 18 10;
    echo "  Press <return> to continue . . . \c";
    read junk;
    clear;
    /bin/rm -f neutral.updated scratch* fort.*;
#
# post-processing flops output file
#
    tput cup 9 27;
    echo " Executing ${bold}flopspost${unbold}";
    tput cup 11 10;
    echo " Updating neutral file to include flops response parameters";
    tput cup 14 10;
    echo " INPUT:  ${bold}flopsout.file${unbold}";
    tput cup 16 10;
    echo " OUTPUT: ${bold}neutral.file${unbold}";
    ${base}/exe/misc/flopspost.exe;
    /bin/rm -f neutral.updated;
    tput cup 19 10;
    echo "  Press <return> to continue . . . \c";
    read junk;
    clear;
#
# clean up
#
clear;
    tput cup 14 10;
    echo "T/BEST neutral.file renamed ${bold}$infile.neutral${unbold}";
    tput cup 16 10;
    echo "User's neutral file is located in ";
    tput cup 17 10;
    echo "$base/in sub-directory";
    tput cup 19 10;
    echo "  Press <return> to continue . . . \c";
    read junk;
    clear;
    cd ${base}/in;
    mv flopsin.file $infile.flopsin;
    mv flopsout.file ${base}/out/$infile.flopsout;
    cp neutral.file $infile.neutral;
    /bin/rm -f B*.OUT M*.OUT scratch*;
    /bin/rm -f mapplot.input trban.input cspan.input;
    /bin/rm -f airfoil.bank databk.data neutral.updated scratch* fort.*;
    /bin/rm -f small.btherm *.amac *.errors nnepwate.out;

  cd ${base}/exe/blasim;
  /bin/rm -f fort.*;
 cd ${base}/in;
#
# graphics processed next
#
    tput cup 9 10;
    echo " Execution of graphic codes to display results ";
    tput cup 12 10;
    echo " Press <return> to continue . . . \c";
    read junk;
    clear;
    ${base}/exe/graphexe/pchart.exe
    ${base}/exe/graphexe/bchart.exe
  /bin/rm -f fort.*;
exit;
```

D.2 Listing of *listexefile*

This file resides in */user/tbest* mother directory. It contains a list identifying executables for all modules. When T/BEST is executed on a workstation, the shell script checks for the existence of these executables. Each T/BEST module will be compiled and linked automatically if its correspondent executable is not present. The file *list.exefile* is listed here:

```
exe/blasim/blasim.exe
exe/misc/blasimpost.exe
exe/misc/report.exe
exe/misc/city.exe
exe/misc/doc.exe
exe/misc/repair.exe
exe/misc/noise.exe
exe/misc/predict.exe
exe/misc/range.exe
exe/misc/nneppost.exe
exe/misc/lcc.exe
exe/misc/blasimsr.exe
exe/misc/neutgen.exe
exe/misc/blasimgen.exe
exe/misc/mtsbgen.exe
exe/misc/mtsbpost.exe
exe/mtsb/mtsb.exe
exe/nnepwate/nnepwate.exe
```

D.3 Database for PREDICT Module

A complete listing of the PREDICT database is listed here. Each block in the database consists of four lines which provides data pertaining to aircraft type and model, engine weight and architecture, speed, landing requirements, etc.

```
FIRST DATA LINE:
aircraft, aircraft name, number of crew, number of passengers, cargo weight
(lb.), wing span (ft.), wing area (sq. ft.), aircraft length (ft.), aircraft height
(ft.),

SECOND DATA LINE:
empty weight (lb.), gross weight (lb.), landing weight (lb.), number of engines,
engine name,
maximum speed (mph), cruise speed (mph or Mach), landing speed (mph), take-off field
length (ft.)

THIRD DATA LINE:
landing field length (ft.), range, engine name, number of compressor stages (spool 1),
number of compressor stages (spool 2), number of compressor stages (spool 3),
number of turbine stages (spool 1), number of turbine stages (spool2),
number of turbine stages (spool 3),

FOURTH DATA LINE:
thrust; specific fuel consumption; overall pressure ratio; engine diameter; engine
length; engine weight
```

```
727-100    name       3  94      900    108.0  1560  133.2  34.0
87600   170000  142500  3  P&WJT8D-9        600   .84      136  7950
4300  2530 PWJT8D-9 13 0 0 4 0 0
14500 .60 15.9 42.5 124 3377

727-200   Advanced          3  145      1525   108.0  1560  153.2  34.0
98300   191500  154500  3  P&WJT8D-15A      600   .84      147  10000
5300  2240 PWJT8D-15A 13 0 0 4 0 0
15500 .59 16.5 42.5 124 3474


737-100       name          2  103      650    93.0   980   94.0   37.0
62000   111000  101000  2  P&WJT8D-9        586   .78      144  4300
4000  1300 PWJT8D-9 13 0 0 4 0 0
14500  .60 15.9 42.5 124 3377

737-200   Advanced          2  120      875    93.0   980   100.2  37.0
60660   116000  103000  2  P&WJT8D-15A      586   .78      148  6860
4260  2140 PWJT8D-15A 13 0 0 4 0 0
15500 .59 16.5 42.5 124 3474

737-200   Advanced          2  120      640    93.0   980   100.2  37.0
62445   128600  107000  2  P&WJT8D-17A      586   .78      152  8970
4580   2840 PWJT8D-17A 13 0 0 4 0 0
16000 .6 16.9 42.5 124 3475


737-300       name          2  141      1068   94.8   980   109.6  36.5
69730   125000  114000  2  CFM56-3-B1       566   .745     153   6650
4580   1840 CFM56-3-B1 1 3 9 1 4 0
20000 .38 22.6 63 93 4276
```

```
737-300        name               2  141      1068   94.8   980   109.6  36.5
69730   135500  114000  2  CFM56-3-B1          566   .745      153    9040
4580  2650 CFM56-3-B1 1 3 9 1 4 0
20000 .38 22.6 63 93 4276

737-300        name               2  141      853    94.8   980   109.6  36.5
70780   139000  114000  2  CFM56-3-B2          566   .745      153    7525
4580  2950 CFM56-3-B2 1 3 9 1 4 0
22000 .39 24.3 63 93 4301

737-400        name               2  159      1375   94.8   980   119.6  36.5
73170   139000  121000  2  CFM56-3-B2          566   .745      158    6600
4910  2250 CFM56-3-B2 1 3 9 1 4 0
22000 .39 24.3 63 93 4301

737-400        name               2  159      1160   94.8   980   119.6  36.5
74170   150500  124000  2  CFM56-3C            566   .745      160    7700
5300  2800 CFM56-3C 1 3 9 1 4 0
23500  .39 1 63 93 4276

737-500        name               2  132      822    94.9   980   101.9  36.6
68180   115500  110000  2  CFM56-3-B1          566   .745      160    7700
5300  2500 CFM56-3-B1 1 3 9 1 4 0
20000 .38 22.6 63 93 4276

737-500        name               2  132      822    94.9   980   101.9  36.6
68180   115500  110000  2  CFM56-3C-1          566   .745      160    7700
5300  2500 CFM56-3C-1 1 3 9 1 4 0
23500  .39 1 63 93 4276

747-100B   Superjet               3  452      6190   195.7  5500  231.9  63.2
373300  750000  564000  4  GECF6-45A2          640   .84       162    8750
6150  5030 GECF6-45A2 4 14 0 2 4 0
46500  .354 26.3 105.3 183 8768

747SR      Superjet               3  550      6190   195.7  5500  231.9  63.2
356400  600000  525000  4  GECF6-45A2          640   .84       156    5900
5800  2300 GECF6-45A2 4 14 0 2 4 0
46500  .354 26.3 105.3 183 8768

747-200B   Superjet               3  452      6190   195.7  5500  231.9  63.5
374100  833000  564000  4  P&WJT9D-7R4G2       640   .84       162    10900
6150  7570 PWJT9D-7R4G2 16 0 0 6 0 0
54750  .360 26.3 97.0 153.6 9100

747-300B   Stretched-upper-deck 3  490        6190   195.7  5500  231.9  63.5
383000  833000  574000  4  P&WJT9D-7R4G2       640   .85       165    10900
6250  7310 PWJT9D-7R4G2 16 0 0 6 0 0
54750  .360 26.3 97.0 153.6 9100

747-200C   Convertible            3  452      5990   195.7  5500  231.9  63.5
386500  833000  630000  4  P&WJT9D             640   .84       175    10900
6950  7200 PWJT9D-7Q,Q3 16 0 0 6 0 0
```

```
53000  .375 24.5 97.0 153.6 9295

747SP      Superjet             3  343      3860   195.7  5500  184.7  65.4
333300  700000  475000  4  RRRB211524D4       640     .85      165   8150
5500  7670 RB211-524D4 1 7 6 1 1 3
53000  .375 30 85.8 122.3 9874

747-400   Advanced-Superjet     2  509      6030   211.0  5650  231.9  63.5
390200  870000  630000  4 GECF6-80C2          630     .85      175   11450
6950  8380 GECF6-80C2B1F 5 14 0 2 5 0
57900  .316 29.9 106 168 9499

757-200          name           2  220      1790   124.8  1951  155.3  44.5
125940  240000  198000  2 P&WPW2037           593     .8       152   7700
4970  4550 PW2037  17 0 0 7 0 0
38250  .33 31.8 84.8 146.8 7160

757-200          name           2  220      1790   124.8  1951  155.3  44.5
125940  240000  198000  2 RRRB211-535E        593     .8       152   7700
4970  4550 RB211-535E 1 6 6 1 1 3
43100 .371 27 79 117.9 7114

767-200          name           2  290      3070   156.1  3050  159.2   52
176100  315000  272000  2 GECF6-80A           594     .8       157   6500
4800  4566 GECF6-80A 4 14 0 2 4 0
48000  .344 27.3 98.1 157 8496

767-200          name           2  290      3070   156.1  3050  159.2   52
176100  315000  272000  2 P&WJT9D-7R4         594     .8       157   6500
4800  4566 PWJT9D-7R4E 16 0 0 6 0 0
50000  .343 24.2 97.0 153.6 8905

767-200ER        name           2  290      3070   156.1  3050  159.2   52
179900  351000  278000  2 P&WJT9D-7R4         594     .8       159   8400
4850  5942 PWJT9D-7R4E 16 0 0 6 0 0
50000  .343 24.2 97.0 153.6 8905

767-200ER        name           2  290      3070   156.1  3050  159.2   52
179900  351000  278000  2 GECF6-80A           594     .8       159   8400
4850  5942 GECF6-80A 4 14 0 2 4 0
48000  .344 27.3 98.1 157 8496

767-300          name           2  290      4030   156.1  3050  180.3   52
190200  351000  300000  2 P&WJT9D-7R4         594     .8       162   8900
5400  4650 PWJT9D-7R4E 16 0 0 6 0 0
50000  .343 24.2 97.0 153.6 8905

767-300          name           2  290      4030   156.1  3050  180.3   52
190200  351000  300000  2 GECF6-80A           594     .8       162   8900
5400  4650 GECF6-80A 4 14 0 2 4 0
48000  .344 27.3 98.1 157 8496

767-300ER        name           2  290      4030   156.1  3050  180.3   52
```

```
196100  400000  320000  2 P&W4000                594     .8     166   9200
5700   6650 PW4060  16 0 0 6 0 0
60000  .330 31.5 97.2 153.6 9400

767-300ER       name                2  290     4030  156.1  3050  180.3   52
196100  400000  320000  2 GECF6-80C2             594     .8     166   9200
5700   6650 GECF6-80C2-D1F 5 14 0 2 5 0
61500  .322 31.8 106 168 9634

L-1011-1    TriStar                 3  400     45750  155.3  3456  177.7  55.3
241731  430000   358000  3 RRRB211-22B           620   0.83    163   8400
6300  3390 RB211-22B 1 7 6 1 1 3
42000  .371 25 84.8 119.4 9195

L-1011-100  TriStar                 3  400     45750  155.3  3456  177.7  55.3
246249  466000   368000  3 RRRB211-22B           620   0.83    163   11240
6450  3975 RB211-22B 1 7 6 1 1 3
42000  .371 25 84.8 119.4 9195

L-1011-200  TriStar                 3  400     45750  155.3  3456  177.7  55.3
248585  466000   368000  3 RRRB211-524B4         620   0.83    163   8000
6450  4140 RB211-524B2 1 7 6 1 1 3
50000  .371 28 84.8 119.4 9814

L-1011-250  TriStar                 3  400     45750  155.3  3456  177.7  55.3
249560  496000   368000  3 RRRB211-524B4         620   0.83    163   9200
6450  5405 RB211-524B2 1 7 6 1 1 3
50000  .371 28 84.8 119.4 9814

L-1011-500  TriStar                 3  330     61500  164.3  3540  164.2  55.3
245730  504000   368000  3 RRRB211-524B4         620   0.83    170   9400
6800  6150 RB211-524B2 1 7 6 1 1 3
50000  .371 28 84.8 119.4 9814

DC-8        Series30                3  176     20850  142.3  2758  150.5  43.3
26525   315000   207000  4 P&WJT4A-9             600    .73    153   9050
6450  7010 PWJT4A-9 15 0 0 3 0 0
16800  .74 1 43.0 144.1 5100

DC-8        Series30                3  176     20850  142.3  2758  150.5  43.3
26525   315000   207000  4 P&WJT4A-11            600    .73    153   9050
6450  7010 PWJT4A-11 15 0 0 3 0 0
17500  .74 1 43.0 144.1 5100

DC-8        Series50                3  189     20850  142.3  2884  150.5  43.3
34854   325000   207000  4 P&WJT3D-3B            600    .73    153   10000
5400  8720 PWJT3D-3 15 0 0 4 0 0
18000  .51 1 53. 136.6 4170

DC-8        Super61                 3  259     66665  142.3  2884  187.4  43.0
48897   328000   240000  4 P&WJT3D-3B            600    .78    165   10000
6150  5460 PWJT3D-3 15 0 0 4 0 0
18000  .51 1 53. 136.6 4170
```

```
DC-8        Super62                 3  169      42580  148.4  2927  157.4  43.3
41903   350000   240000  4 P&WJT3D-7                600   .79     158   10150
5800  6040 PWJT3D-7 15 0 0 4 0 0
19000  .52 1 53.0 136.6 4260


DC-8        Super63                 3  259      66665  148.4  2927  187.4  42.3
53749   355000   258000  4 P&WJT3D-7                600   .78     162   10450
6600  5470 PWJT3D-7 15 0 0 4 0 0
19000  .52 1 53.0 136.6 4260


DC-9        Series10                2  85       9000   89.4   934   104.4  27.5
51000   90700    81700   2 P&WJT8D-1                576   .80     145   6500
4470  1300 PWJT8D-1 13 0 0 4 0 0
14000  .62 16.2 42.5 124 3389


DC-9        Series20                2  85       9000   93.3   1001  104.4  27.5
56000   98000    95300   2 P&WJT8D-9                576   .80     129   5080
3800  1400 PWJT8D-9 13 0 0 4 0 0
14500 .60 15.9 42.5 124 3377


DC-9        Series20                2  85       9000   93.3   1001  104.4  27.5
56000   98000    95300   2 P&WJT8D-11               576   .80     129   5080
3800  1400 PWJT8D-11 13 0 0 4 0 0
15000  .62 16.2 42.5 124 3389


DC-9        Series30                2  110      13425  93.3   1001  119.3  27.5
59000   108000   98100   2 P&WJT8D-9                586   .80     141   7410
4070  1340 PWJT8D-9 13 0 0 4 0 0
14500 .60 15.9 42.5 124 3377


DC-9        Series40                2  120      15285  93.3   1001  125.6  27.5
62500   114000   102000  2 P&WJT8D-11               586   .80     141   7410
4070  1120 PWJT8D-11 13 0 0 4 0 0
15000  .62 16.2 42.5 124 3389


DC-9        Series40                2  120      15285  93.3   1001  125.6  27.5
62500   114000   102000  2 P&WJT8D-15               586   .80     141   7410
4070  1120 PWJT8D-15 13 0 0 4 0 0
15500  .63 16.5 42.5 124 3414


DC-9        Series50                2  135      15510  93.3   1001  133.5  27.5
65150   121000   110000  2 P&WJT8D-15               586   .80     142   8300
4230  1260  PWJT8D-15 13 0 0 4 0 0
15500  .63 16.5 42.5 124 3414


DC-9        Series50                2  135      15510  93.3   1001  133.5  27.5
65150   121000   110000  2 P&WJT8D-17               586   .80     142   8300
4230  1260 PWJT8D-17 13 0 0 4 0 0
16000  .65 16.9 42.5 124 3430

MD-81       NAME                    2  155      18795  107.8  1209  135.6  29.8
78440   140000   128000  2 P&WJT8D-209              576   .80     140   6407
4760  1630 PWJT8D-209 14 0 0 4 0 0
19250  .51 17.4 56.3 154 4410
```

```
MD-81       NAME                  2  155      18795  107.8  1209  135.6  29.8
78440   140000   128000  2 P&WJT8D-217A          576    .80     140    6407
4760  1630 PWJD8D-217A 14 0 0 4 0 0
20850  .53 18.6 56.3 154 4430

MD-82       NAME                  2  155      18795  107.8  1209  135.6  29.8
78528   149500   130000  2 P&WJT8D-217C          576    .80     141    7594
4800  2176 PWJD8D-217C 14 0 0 4 0 0
20850  .5 18.6 56.3 154 4515

MD-83       NAME                  2  155      15195  107.8  1209  135.6  29.8
80238   160000   139500  2 P&WJT8D-219           576    .80     143    8071
5050  2618 PWJD8D-219 14 0 0 4 0 0
21700  .528 19.5 56.3 154 4515

MD-87       NAME                  2  130      14195  107.8  1209  119.1  30.5
74139   140000   128000  2 P&WJT8D-217C          576    .80     135    6275
4780  2405 PWJD8D-217C 14 0 0 4 0 0
20850  .5 18.6 56.3 154 4515

MD-88       NAME                  2  155      18795  107.8  1209  135.6  29.8
78528   149500   130000  2 P&WJT8D-217C          576    .80     141    7594
4800  2176 PWJD8D-217C 14 0 0 4 0 0
20850  .5 18.6 56.3 154 4515

DC-10       Series15              3  380      4618   155.3  3550  180.6  58.1
248500  455000   363500  3 GECF6-50C2F           593   0.82     156    7270
5940  4422 GECF6-50C2 4 14 0 2 4 0
52500  .371 30.4 105.3 183 8731

DC-10       Series30              3  380      4618   165.3  3647  181.6  58.1
267200  572000   403000  3 GECF6-50C2            593   0.82     168    10340
5970  6357 GECF6-50C2 4 14 0 2 4 0
52500  .371 30.4 105.3 183 8731

DC-10       Series40              3  380      4618   165.3  3647  180.6  58.1
271000  572000   403000  3 P&WJT9D-59A           593   0.82     167    10250
5840  5988 PWJTD9-59A 16 0 0 6 0 0
53000  .375 24.5 97.0 153.6 9140

MD-11       NAME                  2  410      6850   169.5  3648  200.8  57.8
287500  618000   430000  3 P&WPW4360             600   0.82     171    10500
6450  7980 PW4460  16 0 0 6 0 0
60000  .330 31.5 97.2 153.6 9400

MD-11       NAME                  2  410      6850   169.5  3648  200.8  57.8
287500  618000   430000  3 GECF6-80C2-D1F        600   0.82     171    10500
6450  7980 GECF6-80C2-D1F 5 14 0 2 5 0
61500  .322 31.8 106 168 9634
```

D.4 Listing of the T/BEST Material Data Bank

This is a complete listing of the material data bank used by BLASIM in the structural analysis of fan, compressor and turbine blades. At this time, the blade is assumed to consist of a single material (isotropic), as a result, matrix data are extracted to supply elastic modulus, density, and strengths of the blade. Once, composite material option, available in BLASIM is activated, both the fiber and matrix data will be processed to determine the composite properties.

```
FIBER PROPERTIES
ADHX  FIBER EQUVIVALENT PROPERTIES OF ADHESIVE.
$
$
$
Number of fibers per end        Nf           1          number
Filament equivalent diameter    df        0.500E-03     inches
Weight density                  Rhof      0.400E-01     lb/in**3
Normal moduli (11)              Ef11      0.300E+06     psi
Normal moduli (22)              Ef22      0.300E+06     psi
Poisson"s ratio (12)            Nuf12     0.450E+00     non-dim
Poisson"s ratio (23)            Nuf23     0.450E+00     non-dim
Shear moduli (12)               Gf12      0.103E+06     psi
Shear moduli (23)               Gf23      0.103E+06     psi
Thermal expansion coef. (11)    Alfaf11   0.570E-04     in/in/F
Thermal expansion coef. (22)    Alfaf22   0.570E-04     in/in/F
Heat conductivity (11)          Kf11      0.125E+01     BTU-in/hr/in**2/F
Heat conductivity (22)          Kf22      0.125E+01     BTU-in/hr/in**2/F
Heat capacity                   Cf        0.250E+00     BTU/lb/F
Fiber tensile strength          SfT       0.800E+04     psi
Fiber compressive strength      SfC       0.150E+05     psi

T300  GRAPHITE FIBER.
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Number of fibers per end        Nf         3000         number
Filament equivalent diameter    df        0.300E-03     inches
Weight density                  Rhof      0.640E-01     lb/in**3
Normal moduli (11)              Ef11      0.320E+08     psi
Normal moduli (22)              Ef22      0.200E+07     psi
Poisson"s ratio (12)            Nuf12     0.200E+00     non-dim
Poisson"s ratio (23)            Nuf23     0.250E+00     non-dim
Shear moduli (12)               Gf12      0.130E+07     psi
Shear moduli (23)               Gf23      0.700E+06     psi
Thermal expansion coef. (11)    Alfaf11   -.550E-06     in/in/F
Thermal expansion coef. (22)    Alfaf22   0.560E-05     in/in/F
HEAT CONDUCTIVITY (11)          KF11      0.403E+03     BTU-IN/HR/IN**2/F
HEAT CONDUCTIVITY (22)          KF22      0.403E+02     BTU-IN/HR/IN**2/F
Heat capacity                   Cf        0.170E+00     BTU/lb/F
Fiber tensile strength          SfT       0.350E+06     psi
Fiber compressive strength      SfC       0.300E+06     psi

MOD2  GRAPHITE FIBER - INTERMEDIATE MODULUS.
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Number of fibers per end        Nf        10000         number
Filament equivalent diameter    df        0.300E-03     inches
Weight density                  Rhof      0.630E-01     lb/in**3
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Normal moduli (11)	Ef11	0.380E+08	psi
Normal moduli (22)	Ef22	0.110E+07	psi
Poisson"s ratio (12)	Nuf12	0.200E+00	non-dim
Poisson"s ratio (23)	Nuf23	0.250E+00	non-dim
Shear moduli (12)	Gf12	0.150E+07	psi
Shear moduli (23)	Gf23	0.800E+06	psi
Thermal expansion coef. (11)	Alfaf11	-.550E-06	in/in/F
Thermal expansion coef. (22)	Alfaf22	0.560E-05	in/in/F
HEAT CONDUCTIVITY (11)	KF11	0.403E+01	BTU-IN/HR/IN**2/F
HEAT CONDUCTIVITY (22)	KF22	0.403E+00	BTU-IN/HR/IN**2/F
Heat capacity	Cf	0.170E+00	BTU/lb/F
Fiber tensile strength	SfT	0.350E+06	psi
Fiber compressive strength	SfC	0.250E+06	psi

MOD1 GRAPHITE FIBER - HIGH MODULUS.
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Number of fibers per end	Nf	10000	number
Filament equivalent diameter	df	0.300E-03	inches
Weight density	Rhof	0.720E-01	lb/in**3
Normal moduli (11)	Ef11	0.600E+08	psi
Normal moduli (22)	Ef22	0.900E+06	psi
Poisson"s ratio (12)	Nuf12	0.200E+00	non-dim
Poisson"s ratio (23)	Nuf23	0.250E+00	non-dim
Shear moduli (12)	Gf12	0.110E+07	psi
Shear moduli (23)	Gf23	0.700E+06	psi
Thermal expansion coef. (11)	Alfaf11	-.550E-06	in/in/F
Thermal expansion coef. (22)	Alfaf22	0.560E-05	in/in/F
HEAT CONDUCTIVITY (11)	KF11	0.403E+01	BTU-IN/HR/IN**2/F
HEAT CONDUCTIVITY (22)	KF22	0.403E+00	BTU-IN/HR/IN**2/F
Heat capacity	Cf	0.170E+00	BTU/lb/F
Fiber tensile strength	SfT	0.250E+06	psi
Fiber compressive strength	SfC	0.200E+06	psi

AS-- GRAPHITE FIBER.
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Number of fibers per end	Nf	10000	number
Filament equivalent diameter	df	0.300E-03	inches
Weight density	Rhof	0.630E-01	lb/in**3
Normal moduli (11)	Ef11	0.310E+08	psi
Normal moduli (22)	Ef22	0.200E+07	psi
Poisson"s ratio (12)	Nuf12	0.200E+00	non-dim
Poisson"s ratio (23)	Nuf23	0.250E+00	non-dim
Shear moduli (12)	Gf12	0.200E+07	psi
Shear moduli (23)	Gf23	0.100E+07	psi
Thermal expansion coef. (11)	Alfaf11	-.550E-06	in/in/F
Thermal expansion coef. (22)	Alfaf22	0.560E-05	in/in/F
HEAT CONDUCTIVITY (11)	KF11	0.403E+01	BTU-IN/HR/IN**2/F
HEAT CONDUCTIVITY (22)	KF22	0.403E+00	BTU-IN/HR/IN**2/F
Heat capacity	Cf	0.170E+00	BTU/lb/F
Fiber tensile strength	SfT	0.400E+06	psi
Fiber compressive strength	SfC	0.400E+06	psi

SGLA S- GLASS FIBER.
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Number of fibers per end	Nf	204	number
Filament equivalent diameter	df	0.360E-03	inches
Weight density	Rhof	0.900E-01	lb/in**3

Normal moduli (11)	Ef11	0.124E+08	psi
Normal moduli (22)	Ef22	0.124E+08	psi
Poisson"s ratio (12)	Nuf12	0.200E+00	non-dim
Poisson"s ratio (23)	Nuf23	0.200E+00	non-dim
Shear moduli (12)	Gf12	0.517E+07	psi
Shear moduli (23)	Gf23	0.517E+07	psi
Thermal expansion coef. (11)	Alfaf11	0.280E-05	in/in/F
Thermal expansion coef. (22)	Alfaf22	0.280E-05	in/in/F
HEAT CONDUCTIVITY (11)	KF11	0.625E+00	BTU-IN/HR/IN**2/F
HEAT CONDUCTIVITY (22)	KF22	0.625E+00	BTU-IN/HR/IN**2/F
Heat capacity	Cf	0.170E+00	BTU/lb/F
Fiber tensile strength	SfT	0.360E+06	psi
Fiber compressive strength	SfC	0.300E+06	psi

KEVL KEVLAR FIBER.
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Number of fibers per end	Nf	580	number
Filament equivalent diameter	df	0.460E-03	inches
Weight density	Rhof	0.530E-01	lb/in**3
Normal moduli (11)	Ef11	0.220E+08	psi
Normal moduli (22)	Ef22	0.600E+06	psi
Poisson"s ratio (12)	Nuf12	0.350E+00	non-dim
Poisson"s ratio (23)	Nuf23	0.350E+00	non-dim
Shear moduli (12)	Gf12	0.420E+06	psi
Shear moduli (23)	Gf23	0.220E+06	psi
Thermal expansion coef. (11)	Alfaf11	-.220E-05	in/in/F
Thermal expansion coef. (22)	Alfaf22	0.300E-04	in/in/F
Heat conductivity (11)	Kf11	0.170E+01	BTU-in/hr/in**2/F
Heat conductivity (22)	Kf22	0.170E+01	BTU-in/hr/in**2/F
Heat capacity	Cf	0.250E+00	BTU/lb/F
Fiber tensile strength	SfT	0.400E+06	psi
Fiber compressive strength	SfC	0.750E+05	psi

BOR5 BORON FIBER - 5 MIL DIAMETER.
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Number of fibers per end	Nf	1	number
Filament equivalent diameter	df	0.560E-02	inches
Weight density	Rhof	0.950E-01	lb/in**3
Normal moduli (11)	Ef11	0.580E+08	psi
Normal moduli (22)	Ef22	0.580E+08	psi
Poisson"s ratio (12)	Nuf12	0.200E+00	non-dim
Poisson"s ratio (23)	Nuf23	0.200E+00	non-dim
Shear moduli (12)	Gf12	0.242E+08	psi
Shear moduli (23)	Gf23	0.242E+08	psi
Thermal expansion coef. (11)	Alfaf11	0.280E-05	in/in/F
Thermal expansion coef. (22)	Alfaf22	0.280E-05	in/in/F
Heat conductivity (11)	Kf11	0.155E+01	BTU-in/hr/in**2/F
Heat conductivity (22)	Kf22	0.155E+01	BTU-in/hr/in**2/F
Heat capacity	Cf	0.310E+00	BTU/lb/F
Fiber tensile strength	SfT	0.600E+06	psi
Fiber compressive strength	SfC	0.700E+06	psi

EGLA E-GLASS FIBER.
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Number of fibers per end	Nf	204	number
Filament equivalent diameter	df	0.360E-03	inches
Weight density	Rhof	0.900E-01	lb/in**3
Normal moduli (11)	Ef11	0.105E+08	psi

Normal moduli (22)	Ef22	0.105E+08	psi
Poisson"s ratio (12)	Nuf12	0.200E+00	non-dim
Poisson"s ratio (23)	Nuf23	0.200E+00	non-dim
Shear moduli (12)	Gf12	0.437E+07	psi
Shear moduli (23)	Gf23	0.437E+07	psi
Thermal expansion coef. (11)	Alfaf11	0.280E-05	in/in/F
Thermal expansion coef. (22)	Alfaf22	0.280E-05	in/in/F
HEAT CONDUCTIVITY (11)	KF11	0.625E+00	BTU-IN/HR/IN**2/F
HEAT CONDUCTIVITY (22)	KF22	0.625E+00	BTU-IN/HR/IN**2/F
Heat capacity	Cf	0.170E+00	BTU/lb/F
Fiber tensile strength	SfT	0.360E+06	psi
Fiber compressive strength	SfC	0.360E+06	psi

SW4M STAINLESS STEEL WIRE.
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Number of fibers per end	Nf	1	number
Filament equivalent diameter	df	0.400E-02	inches
Weight density	Rhof	0.278E+00	lb/in**3
Normal moduli (11)	Ef11	0.290E+08	psi
Normal moduli (22)	Ef22	0.290E+08	psi
Poisson"s ratio (12)	Nuf12	0.300E+00	non-dim
Poisson"s ratio (23)	Nuf23	0.300E+00	non-dim
Shear moduli (12)	Gf12	0.112E+08	psi
Shear moduli (23)	Gf23	0.112E+08	psi
Thermal expansion coef. (11)	Alfaf11	0.560E-05	in/in/F
Thermal expansion coef. (22)	Alfaf22	0.560E-05	in/in/F
Heat conductivity (11)	Kf11	0.108E+03	BTU-in/hr/in**2/F
Heat conductivity (22)	Kf22	0.108E+03	BTU-in/hr/in**2/F
Heat capacity	Cf	0.120E+00	BTU/lb/F
Fiber tensile strength	SfT	0.160E+06	psi
Fiber compressive strength	SfC	0.160E+06	psi

TITF TITANIUM FIBER.
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Number of fibers per end	Nf	1	number
Filament equivalent diameter	df	0.430E-02	inches
Weight density	Rhof	0.161E+00	lb/in**3
Normal moduli (11)	Ef11	0.166E+08	psi
Normal moduli (22)	Ef22	0.166E+08	psi
Poisson"s ratio (12)	Nuf12	0.305E+00	non-dim
Poisson"s ratio (23)	Nuf23	0.305E+00	non-dim
Shear moduli (12)	Gf12	0.636E+07	psi
Shear moduli (23)	Gf23	0.636E+07	psi
Thermal expansion coef. (11)	Alfaf11	0.571E-05	in/in/F
Thermal expansion coef. (22)	Alfaf22	0.571E-05	in/in/F
Heat conductivity (11)	Kf11	0.100E+01	BTU-in/hr/in**2/F
Heat conductivity (22)	Kf22	0.100E+01	BTU-in/hr/in**2/F
Heat capacity	Cf	0.127E+00	BTU/lb/F
Fiber tensile strength	SfT	0.120E+06	psi
Fiber compressive strength	SfC	0.120E+06	psi

TUNG TUNGSTEN FIBER (W-1.5%THO2).
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Number of fibers per end	Nf	1	number
Filament equivalent diameter	df	0.600E-02	inches
Weight density	Rhof	0.697E+00	lb/in**3
Normal moduli (11)	Ef11	0.521E+08	psi
Normal moduli (22)	Ef22	0.521E+08	psi

Poisson"s ratio (12)	Nuf12	0.290E+00	non-dim
Poisson"s ratio (23)	Nuf23	0.290E+00	non-dim
Shear moduli (12)	Gf12	0.202E+08	psi
Shear moduli (23)	Gf23	0.202E+08	psi
Thermal expansion coef. (11)	Alfaf11	0.244E-05	in/in/F
Thermal expansion coef. (22)	Alfaf22	0.244E-05	in/in/F
Heat conductivity (11)	Kf11	0.828E+01	BTU-in/hr/in**2/F
Heat conductivity (22)	Kf22	0.828E+01	BTU-in/hr/in**2/F
Heat capacity	Cf	0.316E-01	BTU/lb/F
Fiber tensile strength	SfT	0.355E+06	psi
Fiber compressive strength	SfC	0.355E+06	psi

SICA SICA FIBER (W-1.5%THO2).
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Number of fibers per end	Nf	1	number
Filament equivalent diameter	df	0.600E-02	inches
Weight density	Rhof	0.697E+00	lb/in**3
Normal moduli (11)	Ef11	0.580E+08	psi
Normal moduli (22)	Ef22	0.580E+08	psi
Poisson"s ratio (12)	Nuf12	0.250E+00	non-dim
Poisson"s ratio (23)	Nuf23	0.250E+00	non-dim
Shear moduli (12)	Gf12	0.232E+08	psi
Shear moduli (23)	Gf23	0.232E+08	psi
Thermal expansion coef. (11)	Alfaf11	0.270E-05	in/in/F
Thermal expansion coef. (22)	Alfaf22	0.270E-05	in/in/F
Heat conductivity (11)	Kf11	0.828E+01	BTU-in/hr/in**2/F
Heat conductivity (22)	Kf22	0.828E+01	BTU-in/hr/in**2/F
Heat capacity	Cf	0.316E-01	BTU/lb/F
Fiber tensile strength	SfT	0.355E+06	psi
Fiber compressive strength	SfC	0.355E+06	psi

SICA SILICON CARBIDE ON ALUMINUM. SEPT 7,1987. (6)
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Number of fibers per end	Nf	1	number
Filament equivalent diameter	df	0.560E-02	inches
Weight density	Rhof	0.110E+00	lb/in**3
Normal moduli (11)	Ef11	0.620E+08	psi
Normal moduli (22)	Ef22	0.620E+08	psi
Poisson"s ratio (12)	Nuf12	0.300E+00	non-dim
Poisson"s ratio (23)	Nuf23	0.300E+00	non-dim
Shear moduli (12)	Gf12	0.238E+08	psi
Shear moduli (23)	Gf23	0.238E+08	psi
Thermal expansion coef. (11)	Alfaf11	0.180E-05	in/in/F
Thermal expansion coef. (22)	Alfaf22	0.180E-05	in/in/F
Heat conductivity (11)	Kf11	0.750E+00	BTU-in/hr/in**2/F
Heat conductivity (22)	Kf22	0.750E+00	BTU-in/hr/in**2/F
Heat capacity	Cf	0.290E+00	BTU/lb/F
Fiber tensile strength	SfT	0.500E+06	psi
Fiber compressive strength	SfC	0.650E+06	psi

OVER END OF FIBER PROPERTIES

MATRIX PROPERTIES
BORM BORON MATRIX. AUG 22 1990 (3)
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Weight density	Rhom	0.950E-01	lb/in**3
Normal modulus	Em	0.580E+08	psi
Poisson"s ratio	Num	0.200E+00	non-dim

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Thermal expansion coef.         Alfa m    0.280E-05    in/in/F
Matrix heat conductivity        Km        0.155E+01    BTU-in/hr/in**2/F
Heat capacity                   Cm        0.310E+00    BTU/lb/F
Matrix tensile strength         SmT       0.600E+06    psi
Matrix compressive strength     SmC       0.700E+06    psi
Matrix shear strength           SmS       0.100E+06    psi
Allowable tensile strain        eps mT    0.120E+00    in/in
Allowable compr. strain         eps mC    0.120E+00    in/in
Allowable shear strain          eps mS    0.120E+00    in/in
Allowable torsional strain      eps mTOR  0.120E+00    in/in
Void heat conductivity          kv        0.190E-01    BTU-in/hr/in**2/F
Glass transition temperature    Tgdr      0.180E+04    F

TI15  TITANIUM MATRIX. AUG 25, 1988.        (3)
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Weight density                  Rhom      0.172E+00    lb/in**3
Normal modulus                  Em        0.123E+08    psi
Poisson"s ratio                 Num       0.320E+00    non-dim
Thermal expansion coef.         Alfa m    0.450E-05    in/in/F
Matrix heat conductivity        Km        0.390E+00    BTU-in/hr/in**2/F
Heat capacity                   Cm        0.120E+00    BTU/lb/F
Matrix tensile strength         SmT       0.130E+06    psi
Matrix compressive strength     SmC       0.130E+06    psi
Matrix shear strength           SmS       0.910E+05    psi
Allowable tensile strain        eps mT    0.120E+00    in/in
Allowable compr. strain         eps mC    0.120E+00    in/in
Allowable shear strain          eps mS    0.120E+00    in/in
Allowable torsional strain      eps mTOR  0.120E+00    in/in
Void heat conductivity          kv        0.190E-01    BTU-in/hr/in**2/F
Glass transition temperature    Tgdr      0.180E+04    F

ADHX EQUVIVALENT MATRIX PROPS. FOR ADHESIVE.
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Weight density                  Rhom      0.400E-01    lb/in**3
Normal modulus                  Em        0.300E+06    psi
Poisson"s ratio                 Num       0.450E+00    non-dim
Thermal expansion coef.         Alfa m    0.570E-04    in/in/F
Matrix heat conductivity        Km        0.125E+01    BTU-in/hr/in**2/F
Heat capacity                   Cm        0.250E+00    BTU/lb/F
Matrix tensile strength         SmT       0.800E+04    psi
Matrix compressive strength     SmC       0.150E+05    psi
Matrix shear strength           SmS       0.800E+04    psi
Allowable tensile strain        eps mT    0.810E-01    in/in
Allowable compr. strain         eps mC    0.150E+00    in/in
Allowable shear strain          eps mS    0.100E+00    in/in
Allowable torsional strain      eps mTOR  0.100E+00    in/in
Void heat conductivity          kv        0.225E+00    BTU-in/hr/in**2/F
Glass transition temperature    Tgdr      0.350E+03    F

ALT6  ALUMINUM MATRIX. DEC 16, 1987.        (1)
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Weight density                  Rhom      0.980E-01    lb/in**3
Normal modulus                  Em        0.100E+08    psi
Poisson"s ratio                 Num       0.300E+00    non-dim
Thermal expansion coef.         Alfa m    0.131E-04    in/in/F
Matrix heat conductivity        Km        0.866E+01    BTU-in/hr/in**2/F
Heat capacity                   Cm        0.230E+00    BTU/lb/F
Matrix tensile strength         SmT       0.180E+05    psi
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Matrix compressive strength	SmC	0.180E+05	psi
Matrix shear strength	SmS	0.120E+05	psi
Allowable tensile strain	eps mT	0.300E+00	in/in
Allowable compr. strain	eps mC	0.300E+00	in/in
Allowable shear strain	eps mS	0.300E+00	in/in
Allowable torsional strain	eps mTOR	0.300E+00	in/in
Void heat conductivity	kv	0.190E-01	BTU-in/hr/in**2/F
Glass transition temperature	Tgdr	0.108E+04	F

SPOX IMHS INTERMEDIATE MODULUS HIGH STRENGTH MATRIX.
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Weight density	Rhom	0.443E-01	lb/in**3
Normal modulus	Em	0.500E+06	psi
Poisson"s ratio	Num	0.410E+00	non-dim
Thermal expansion coef.	Alfa m	0.570E-04	in/in/F
MATRIX HEAT CONDUCTIVITY	KM	0.104E+00	BTU-IN/HR/IN**2/F
Heat capacity	Cm	0.250E+00	BTU/lb/F
Matrix tensile strength	SmT	0.150E+05	psi
Matrix compressive strength	SmC	0.300E+05	psi
Matrix shear strength	SmS	0.150E+05	psi
Allowable tensile strain	eps mT	0.140E-01	in/in
Allowable compr. strain	eps mC	0.420E-01	in/in
Allowable shear strain	eps mS	0.320E-01	in/in
Allowable torsional strain	eps mTOR	0.380E-01	in/in
Void heat conductivity	kv	0.225E+00	BTU-in/hr/in**2/F
Glass transition temperature	Tgdr	0.420E+03	F

EPOX IMHS INTERMEDIATE MODULUS HIGH STRENGTH MATRIX.
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Weight density	Rhom	0.443E-01	lb/in**3
Normal modulus	Em	0.500E+06	psi
Poisson"s ratio	Num	0.350E+00	non-dim
Thermal expansion coef.	Alfa m	0.428E-04	in/in/F
MATRIX HEAT CONDUCTIVITY	KM	0.104E+00	BTU-IN/HR/IN**2/F
Heat capacity	Cm	0.250E+00	BTU/lb/F
Matrix tensile strength	SmT	0.150E+05	psi
Matrix compressive strength	SmC	0.350E+05	psi
Matrix shear strength	SmS	0.130E+05	psi
Allowable tensile strain	eps mT	0.200E-01	in/in
Allowable compr. strain	eps mC	0.500E-01	in/in
Allowable shear strain	eps mS	0.450E-01	in/in
Allowable torsional strain	eps mTOR	0.450E-01	in/in
Void heat conductivity	kv	0.225E+00	BTU-in/hr/in**2/F
Glass transition temperature	Tgdr	0.420E+03	F

ERLA HMHS HIGH MODULUS HIGH STRENGTH MATRIX.
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Weight density	Rhom	0.450E-01	lb/in**3
Normal modulus	Em	0.750E+06	psi
Poisson"s ratio	Num	0.350E+00	non-dim
Thermal expansion coef.	Alfa m	0.400E-04	in/in/F
Matrix heat conductivity	Km	0.104E+00	BTU-in/hr/in**2/F
Heat capacity	Cm	0.250E+00	BTU/lb/F
Matrix tensile strength	SmT	0.200E+05	psi
Matrix compressive strength	SmC	0.500E+05	psi
Matrix shear strength	SmS	0.150E+05	psi
Allowable tensile strain	eps mT	0.200E-01	in/in
Allowable compr. strain	eps mC	0.500E-01	in/in

Allowable shear strain	eps mS	0.400E-01	in/in
Allowable torsional strain	eps mTOR	0.400E-01	in/in
Void heat conductivity	kv	0.225E+00	BTU-in/hr/in**2/F
Glass transition temperature	Tgdr	0.420E+03	F

POLY POLYIMIDE MATRIX.
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Weight density	Rhom	0.440E-01	lb/in**3
Normal modulus	Em	0.500E+06	psi
Poisson"s ratio	Num	0.350E+00	non-dim
Thermal expansion coef.	Alfa m	0.200E-04	in/in/F
Matrix heat conductivity	Km	0.146E+00	BTU-in/hr/in**2/F
Heat capacity	Cm	0.250E+00	BTU/lb/F
Matrix tensile strength	SmT	0.150E+05	psi
Matrix compressive strength	SmC	0.300E+05	psi
Matrix shear strength	SmS	0.130E+05	psi
Allowable tensile strain	eps mT	0.200E-01	in/in
Allowable compr. strain	eps mC	0.400E-01	in/in
Allowable shear strain	eps mS	0.350E-01	in/in
Allowable torsional strain	eps mTOR	0.350E-01	in/in
Void heat conductivity	kv	0.225E+00	BTU-in/hr/in**2/F
Glass transition temperature	Tgdr	0.700E+03	F

ALTX ALUMINUM MATRIX.
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Weight density	Rhom	0.950E-01	lb/in**3
Normal modulus	Em	0.100E+08	psi
Poisson"s ratio	Num	0.330E+00	non-dim
Thermal expansion coef.	Alfa m	0.129E-04	in/in/F
Matrix heat conductivity	Km	0.866E+01	BTU-in/hr/in**2/F
Heat capacity	Cm	0.230E+00	BTU/lb/F
Matrix tensile strength	SmT	0.520E+05	psi
Matrix compressive strength	SmC	0.520E+05	psi
Matrix shear strength	SmS	0.260E+05	psi
Allowable tensile strain	eps mT	0.520E-02	in/in
Allowable compr. strain	eps mC	0.520E-02	in/in
Allowable shear strain	eps mS	0.905E-02	in/in
Allowable torsional strain	eps mTOR	0.905E-02	in/in
Void heat conductivity	kv	0.225E+00	BTU-in/hr/in**2/F
Glass transition temperature	Tgdr	0.108E+04	F

TIT6 TITANIUM MATRIX.
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Weight density	Rhom	0.161E+00	lb/in**3
Normal modulus	Em	0.165E+08	psi
Poisson"s ratio	Num	0.300E+00	non-dim
Thermal expansion coef.	Alfa m	0.570E-05	in/in/F
Matrix heat conductivity	Km	0.100E+01	BTU-in/hr/in**2/F
Heat capacity	Cm	0.127E+00	BTU/lb/F
Matrix tensile strength	SmT	0.120E+06	psi
Matrix compressive strength	SmC	0.120E+06	psi
Matrix shear strength	SmS	0.800E+05	psi
Allowable tensile strain	eps mT	0.730E-02	in/in
Allowable compr. strain	eps mC	0.730E-02	in/in
Allowable shear strain	eps mS	0.124E-01	in/in
Allowable torsional strain	eps mTOR	0.124E-01	in/in
Void heat conductivity	kv	0.225E+00	BTU-in/hr/in**2/F
Glass transition temperature	Tgdr	0.150E+04	F

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EPOC  EPOXY MATRIX.
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Weight density                  Rhom       0.440E-01    lb/in**3
Normal modulus                  Em         0.500E+06    psi
Poisson"s ratio                 Num        0.350E+00    non-dim
Thermal expansion coef.         Alfa m     0.360E-04    in/in/F
Matrix heat conductivity        Km         0.146E+00    BTU-in/hr/in**2/F
Heat capacity                   Cm         0.250E+00    BTU/lb/F
Matrix tensile strength         SmT        0.150E+05    psi
Matrix compressive strength     SmC        0.250E+05    psi
Matrix shear strength           SmS        0.130E+05    psi
Allowable tensile strain        eps mT     0.200E-02    in/in
Allowable compr. strain         eps mC     0.500E-02    in/in
Allowable shear strain          eps mS     0.350E-02    in/in
Allowable torsional strain      eps mTOR   0.350E-02    in/in
Void heat conductivity          kv         0.225E+00    BTU-in/hr/in**2/F
Glass transition temperature    Tgdr       0.410E+03    F

SSAL  STAINLESS STEEL MATRIX.
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Weight density                  Rhom       0.281E+00    lb/in**3
Normal modulus                  Em         0.289E+08    psi
Poisson"s ratio                 Num        0.300E+00    non-dim
Thermal expansion coef.         Alfa m     0.570E-05    in/in/F
Matrix heat conductivity        Km         0.158E+01    BTU-in/hr/in**2/F
Heat capacity                   Cm         0.120E+00    BTU/lb/F
Matrix tensile strength         SmT        0.160E+06    psi
Matrix compressive strength     SmC        0.160E+06    psi
Matrix shear strength           SmS        0.120E+06    psi
Allowable tensile strain        eps mT     0.550E-02    in/in
Allowable compr. strain         eps mC     0.550E-02    in/in
Allowable shear strain          eps mS     0.104E-01    in/in
Allowable torsional strain      eps mTOR   0.104E-01    in/in
Void heat conductivity          kv         0.225E+00    BTU-in/hr/in**2/F
Glass transition temperature    Tgdr       0.266E+04    F

BERY  BERYLLIUM MATRIX.
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Weight density                  Rhom       0.570E-01    lb/in**3
Normal modulus                  Em         0.440E+08    psi
Poisson"s ratio                 Num        0.100E+00    non-dim
Thermal expansion coef.         Alfa m     0.640E-05    in/in/F
Matrix heat conductivity        Km         0.968E+01    BTU-in/hr/in**2/F
Heat capacity                   Cm         0.450E+00    BTU/lb/F
Matrix tensile strength         SmT        0.133E+06    psi
Matrix compressive strength     SmC        0.133E+06    psi
Matrix shear strength           SmS        0.770E+05    psi
Allowable tensile strain        eps mT     0.302E-02    in/in
Allowable compr. strain         eps mC     0.302E-02    in/in
Allowable shear strain          eps mS     0.385E-02    in/in
Allowable torsional strain      eps mTOR   0.385E-02    in/in
Void heat conductivity          kv         0.225E+00    BTU-in/hr/in**2/F
Glass transition temperature    Tgdr       0.234E+04    F

LMLS LOW MODULUS LOW STRENGTH MATRIX.
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Weight density                  Rhom       0.420E-01    lb/in**3
Normal modulus                  Em         0.320E+06    psi
Poisson"s ratio                 Num        0.430E+00    non-dim
Thermal expansion coef.         Alfa m     0.570E-04    in/in/F
Matrix heat conductivity        Km         0.104E+00    BTU-in/hr/in**2/F
Heat capacity                   Cm         0.250E+00    BTU/lb/F
Matrix tensile strength         SmT        0.800E+04    psi
Matrix compressive strength     SmC        0.150E+05    psi
Matrix shear strength           SmS        0.800E+04    psi
Allowable tensile strain        eps mT     0.810E-01    in/in
Allowable compr. strain         eps mC     0.150E+00    in/in
Allowable shear strain          eps mS     0.100E+00    in/in
Allowable torsional strain      eps mTOR   0.100E+00    in/in
Void heat conductivity          kv         0.225E+00    BTU-in/hr/in**2/F
Glass transition temperature    Tgdr       0.350E+03    F

IMLS  INTERMEDIATE MODULUS LOW STRENGTH MATRIX.
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Weight density                  Rhom       0.460E-01    lb/in**3
Normal modulus                  Em         0.500E+06    psi
Poisson"s ratio                 Num        0.410E+00    non-dim
Thermal expansion coef.         Alfa m     0.570E-04    in/in/F
Matrix heat conductivity        Km         0.104E+00    BTU-in/hr/in**2/F
Heat capacity                   Cm         0.250E+00    BTU/lb/F
Matrix tensile strength         SmT        0.700E+04    psi
Matrix compressive strength     SmC        0.210E+05    psi
Matrix shear strength           SmS        0.700E+04    psi
Allowable tensile strain        eps mT     0.140E-01    in/in
Allowable compr. strain         eps mC     0.420E-01    in/in
Allowable shear strain          eps mS     0.320E-01    in/in
Allowable torsional strain      eps mTOR   0.320E-01    in/in
Void heat conductivity          kv         0.225E+00    BTU-in/hr/in**2/F
Glass transition temperature    Tgdr       0.420E+03    F

FECR  SUPERALLOY (FE-25%CR-4%AL-1%Y) MATRIX
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Weight density                  Rhom       0.260E+00    lb/in**3
Normal modulus                  Em         0.302E+08    psi
Poisson"s ratio                 Num        0.300E+00    non-dim
Thermal expansion coef.         Alfa m     0.528E-05    in/in/F
Matrix heat conductivity        Km         0.125E+01    BTU-in/hr/in**2/F
Heat capacity                   Cm         0.112E+00    BTU/lb/F
Matrix tensile strength         SmT        0.110E+06    psi
Matrix compressive strength     SmC        0.110E+06    psi
Matrix shear strength           SmS        0.660E+05    psi
Allowable tensile strain        eps mT     0.256E-02    in/in
Allowable compr. strain         eps mC     0.256E-02    in/in
Allowable shear strain          eps mS     0.154E-02    in/in
Allowable torsional strain      eps mTOR   0.154E-02    in/in
Void heat conductivity          kv         0.225E+00    BTU-in/hr/in**2/F
Glass transition temperature    Tgdr       0.105E+04    F

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13. ABSTRACT ***(Maximum 200 words)***

The Technology Benefit Estimator (T/BEST) system is a formal method to assess advanced technologies and quantify the benefit contributions for prioritization. T/BEST may be used to provide guidelines to identify and prioritize high payoff research areas, help manage research and limited resources, show the link between advanced concepts and the bottom line, i.e., accrued benefit and value, and to credibly communicate the benefits of research. The T/BEST software computer program is specifically designed for estimating benefits, and benefit sensitivities, of introducing new technologies into existing propulsion systems. Key engine cycle, structural, fluid, mission and cost analysis modules are used to provide a framework for interfacing with advanced technologies. An open-ended, modular approach is used to allow for modification and addition of both key and advanced technology modules. T/BEST has a hierarchical framework that yields varying levels of benefit estimation accuracy that are dependent on the degree of input detail available. This hierarchical feature permits rapid estimation of technology benefits even when the technology is at the conceptual stage. As knowledge of the technology details increases the accuracy of the benefit analysis increases. Included in T/BEST's framework are correlations developed from a statistical data base that is relied upon if there is insufficient information given in a particular area, e.g., fuel capacity or aircraft landing weight. Statistical predictions are not required if these data are specified in the mission requirements. The engine cycle, structural, fluid, cost, noise, and emissions analyses interact with the default or user material and component libraries to yield estimates of specific global benefits: range, speed, thrust, capacity, component life, noise, emissions, specific fuel consumption, component and engine weights, pre-certification test, mission performance engine cost, direct operating cost, life cycle cost, manufacturing cost, development cost, risk, and development time. Currently, T/BEST operates on stand-alone or networked workstations, and uses a UNIX shell or script to control the operation of interfaced FORTRAN based analyses. T/BEST's interface structure works equally well with non-FORTRAN or mixed software analyses. This interface structure is designed to maintain the integrity of the expert's analyses by interfacing with expert's existing input and output files. Parameter input and output data (e.g., number of blades, hub diameters, etc.) are passed via T/BEST's neutral file, while copious data (e.g., finite element models, profiles, etc.) are passed via file pointers that point to the experts' analyses output files. In order to make the communications between the T/BEST's neutral file and attached analyses codes simple, only two software commands, PUT and GET, are required. This simplicity permits easy access to all input and output variables contained within the neutral file. Both public domain and proprietary analyses codes may be attached with a minimal amount of effort, while maintaining full data and analysis integrity, and security. T/BEST's software framework, status, beginner-to-expert operation, interface architecture, analysis module addition, key analysis modules are discussed. Representative examples of T/BEST benefit analyses are shown.

14. SUBJECT TERMS

Engine cycle; Flight cycle; Structural analysis; Computational fluid dynamics; Cost analysis; NOISE; Maintenance; Aircraft/engine weights analysis; Thermal analysis; Optimization, MDO; MDA; Technology benefits

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