

## NASTRAN DATA DECK GENERATION ON THE PC

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### SUMMARY

Using two commercial programs an application has been developed to aid in generating a run-ready NASTRAN data deck on the PC. Macros are used to access relevant reference material and card files while editing the deck. The application can be easily customized to suit individual or group needs.

### INTRODUCTION and BACKGROUND

Since 1984 I have been consulting on a project directed toward providing NASTRAN help on TSO. The initial task was to install documentation from the User's Manual. In the first year about 1200 panels of information, primarily data card descriptions and rigid format listings were generated. During this period I developed my own ideas of what the ultimate scope of this project might be.

Early in 1985 the IBM PC XT computer arrived in our engineering department with various application programs. Other software was available to cover almost any conceivable need. These programs demonstrate the true power of the PC and provide the user with great utility.

Also during this period I needed to monitor and submit TSO jobs from an off-site PC where the usual NASTRAN reference material was not available. This combination of events induced me to proceed with the NASTRAN application described in this paper.

### DEFINING THE APPLICATION

Having appropriate commercial tools available for this project was instrumental to its undertaking. This software also defined its operational characteristics and limitations. The most important operational feature I wanted was the ability to edit the NASTRAN deck in one window and view the reference material in another. Other desirable features included: quick access to the reference material; full featured editor; and an application which would be easy to learn, use, and modify.

With the application tools selected only a minimum amount of programming would be required. Most of the development time would be spent selecting the reference material to be presented.

## ORGANIZING THE REFERENCE DATA

The selection of reference data depends on the users to which the application is directed. Possible users include: general; members of a group or department; beginning; occasional; experienced; specific individual; or specific topic user.

For the prototype application described here the selection is generally for an intermediate experienced individual. References are also slanted to the type of work I do: modal analysis; frequency and transient response; DMAP; trouble shooting and feature verification using small problems.

Sources from which information can be drawn include: NASTRAN Manuals; symposium proceedings; handbooks; project reports; class notes; TSO files; and personal notes. Some of the most useful information which could be included here comes from the experienced user; NASTRAN bugs and idiosyncrasies and guidelines for effective analysis.

Organization of the reference data is best seen by the Main Menu in Figure 1 and the sub-menus in Figures 2 and 3. Examples of specific items included are given in the remaining figures. In general the items included are: job control language (JCL); NASTRAN card formats and examples; and help with regard to commands, i.e., any reference which may be required during deck generation.

## IMPLEMENTATION

The software application tools selected for this project were Sidekick and Superkey, copyrighted products of Borland International (References 1 and 2). Both are "RAM resident" programs which means that once they are loaded into the computer they become active or inactive with a keystroke. Sidekick and Superkey are designed to work with each other and they make a good team.

Sidekick is composed of several utilities. The one called NOTEPAD is used here for the editor. NOTEPAD is a full screen editor with features more than adequate for this application. A few commands require three-key combinations but they quickly become very natural. Other commands have been assigned to the PC's special keys. The window size of NOTEPAD may be varied, but it is usually convenient to let it occupy the lower one half of the screen for this application.

Superkey's primary function is writing macros. Two types of macros are used: keyboard macros which allow a series of keystrokes to be assigned to a single key; and display macros which enable a keystroke to write a window of text to the screen. The macro file written for this development contains primarily display macros. A few keyboard macros are used to simplify the input of JCL cards. Some information on writing this macro file is given in Appendix B, with a full discussion in Reference 2. This file represents the programming effort required.

## USING THE APPLICATION

The application is started by inserting the program diskette (see Appendix A) in drive A and starting the computer (booting up). After a minute or so the Main Menu and general instructions are presented in the top portion of the screen (Figure 1). Items from the Main Menu are selected by using the shifted function keys. To scroll a display use the PgUp/PgDn keys. Press Esc to remove a display before selecting another menu item.

The JCL and Bulk Data selections have sub-menus which access items using prefix keys Alt and Ctrl (Figures 2 and 6). From the JCL menu you may select card files to merge with the NASTRAN data. The last item on the JCL menu (Alt6) selects a display macro rather than a card file.

When activating NOTEPAD for the first time it is best to press Esc to clear the screen, then press CtrlAlt. From the Sidekick menu press N for NOTEPAD. The NASTRAN file is read in automatically (see Appendix A). To start a new file press F3 and enter a name for your data deck. When you exit NOTEPAD, which you must do to either scroll a display or select a new menu item, press CtrlAlt. Thereafter, the NOTEPAD window is toggled by CtrlAlt: passing through the Sidekick menu is not necessary.

NOTEPAD commands which are most useful in editing the NASTRAN deck, in addition to those listed at the bottom of the screen, are given under NOTEPAD Commands (ShftF10). The very useful operation of importing data from the display screen, initiated by pressing F4, is fully explained there and in Reference 1. Examples are shown in Figures 7 and 9. The Sidekick calculator utility is available while in NOTEPAD by pressing AltC.

Generating the NASTRAN data deck then consists of repeatedly editing and toggling the NOTEPAD window while either merging card files or viewing a display window until the data deck is complete. Save the file by pressing F2.

Finally you will want to send the completed deck to TSO and submit it to the mainframe for execution. If you have copied a communications program to the application diskette (see Appendix A) and your PC is connected by modem to TSO, switch to the COMM directory and logon. You may also want to examine the run results while on the PC.

## CONCLUDING REMARKS

Generating a macro file is a relatively easy task; only a few Superkey commands are required to convert NASTRAN experience into a ready reference on the PC (or just to have available as a listing). The file is also easy to update as new experiences accumulate. And when one file is filled, additional ones can follow. These "database" files also serve to collect and organize NASTRAN data that frequently is misplaced or is generally distributed across many references and users.

## REFERENCES

1. Sidekick Owners Handbook, Borland International, 1985.
2. Superkey Owners Handbook, Borland International, 1985.

```

=====
||          MAIN MENU          NASTRAN AIDE - GENERAL INSTRUCTIONS  || | |
||                               ||                               ||
|| ShftF1 Main Menu           Esc      Exit Menu              ||
|| ShftF2 JCL                 ShftFn   Menu Listed            ||
|| ShftF3 Executive Control   PgDn/PgUp Scroll           ||
|| ShftF4 Case Control        CtrlAlt Toggle NOTEPAD Editor  ||
|| ShftF5 Bulk Data          Altn     Read Card File into NOTEPAD ||
|| ShftF6 DMAP Statements                                     ||
|| ShftF7 Alters & DMAP      Note: Examples are inserted in text ||
|| ShftF8 Other (Card Replication)                             ||
|| ShftF9 TSO Commands                                             ||
|| ShftF10 NOTEPAD Commands                                       ||
=====
r  A:\NASTRAN.                Line 1   Col 1   Insert   Indent
||You are now in NASTRAN MICROLAND. Happy Hunting! Press F3 for a new file.
||
||
||
||
||
||
=====
F1-help F2-save F3-new file F4-import data F9-expand F10-contract Esc-exit

```

Figure 1 Main Menu

```

=====
||          JCL CtrlAlt for NOTEPAD Altn   Read Card File into NOTEPAD  || | |
||                               ||                               ||
|| Alt1  IBM                                     ||
|| Alt2  IBM - data base; exec ctrl; case ctrl; optional plot ||
|| Alt3  Cray - optional plot; sample run          ||
|| Alt4  FORTRAN Compilation and Linkedit         ||
|| Alt5  Create Load Module                       ||
|| Alt6  Miscellaneous IBM JCL (display macro)    ||
||                               ||                               ||
=====
r  A:\NASTRAN.                Line 1   Col 1   Insert   Indent
||//YTT5068N JOB 'GUYAN R J B-01280205*04101720100          XXXXXX3  ',
||// REGION=1024K,TIME=5,MSGLEVEL=1,MSGCLASS=4,NOTIFY=YTT5068
||//*MAIN  ORG=RM001          CASE1.CTL
||//*FORMAT PR,DDNAME=JES10001,CONTROL=SINGLE
||//NASTRAN EXEC @MSCNAST,DB1DISP=NEW,DB1CAT=KEEP,DB01='&CASE1'
||//D.SYSIN DD *
||NASTRAN NLINES=35
||ID      NASTRAN,CASE1
||APP     DISP
||SQL     63
=====
F1-help F2-save F3-new file F4-import data F9-expand F10-contract Esc-exit

```

Figure 2 JCL Menu

```

=====
EXECUTIVE CONTROL  CtrlAlt for NOTEPAD  PgDn/PgUp  Scroll
=====
|
|
| NASTRAN          Optional - p 2.1-1a
| ID              A1,A2 $   Required - Any legal alphanumeric field for problem ID
| CHKPNT          A1,A2 $   A1=YES for checkpointing - default is NO checkpointing
|                 A2=DISK if checkpoint file is on a direct access device
| APP            A         A=DISP (default), =HEAT, =DMAP (default if DMAP seq-
|                 quence is submitted)
| SOL            K1        Required - K1= 3 Normal modes           p 2.2-4
|                 K1= 5 Buckling
|
=====
| A:\NASTRAN.          Line 12  Col 1  Insert  Indent
| //NASTRAN EXEC @MSCNAST,DB1DISP=NEW,DB1CAT=KEEP,DB01='%CASE1'
| //D,SYSIN DD *
| NASTRAN NLines=35
| ID      NASTRAN,CASE1
| APP     DISP
| SOL     63
| TIME    5
| DIAG    8
| CEND
| TITLE=MSC/NASTRAN CASE1
=====
F1-help F2-save F3-new file F4-import data F9-expand F10-contract Esc-exit

```

Figure 3 Executive Control Window

```

=====
CASE CONTROL  CtrlAlt for NOTEPAD  PgDn/PgUp  Scroll
=====
|
| SUB-SECTIONS
|
| OUTPUT CONTROL
| BULK DATA SELECTION
| OUTPUT SELECTION
| SUBCASE CONTROL
| STRUCTURAL PLOTTER
| XY PLOTTER
|
|
|
|
=====
| A:\NASTRAN.          Line 17  Col 1  Insert  Indent
| TITLE=MSC/NASTRAN CASE1
| SUBTITLE=MODAL ANALYSIS
| ECHO=BOTH
| SPC=1
| MPC=2
=====
F1-help F2-save F3-new file F4-import data F9-expand F10-contract Esc-exit

```

Figure 4 Case Control Sub-sections

```

=====
|| XY PLOTTER
||
||General format: XYCOM TYPE SUBCASE /a1(b1,c1),a2(b2,c2),etc/d1(e1,f1),etc
||
||XYCOM: XYPLOT, XYPRINT, XYPUNCH, XYPAPLOT
||TYPE: DISP, VELO, ACCE, ELFORCE, STRESS, OLOAD, SPCF, SDISP, SVELO, SACCE
||SUBCASE: Default is all
||
||Example: PLOTID=SAMPLE PROBLEM I M ENGINEER RMOO1 DNY
||          OUTPUT(XYPLOT)
||          PLOTTER SC $           Plot symbols: Cyclic for
||          XGRID LINES=YES $      multiple curves on same grid
||          YGRID LINES=YES $      CURVLINE=1 (X) Default
||          XAXIS=YES $            =2 (*)
||          YAXIS=YES $            =3 (+)
=====
|| A:\NASTRAN.                      Line 23  Col 1  Insert  Indent
|| DISP=ALL
|| ELFORCE=ALL
|| SPCFORCE=ALL
|| OLOAD=ALL
||BEGIN BULK
=====
F1-help F2-save F3-new file F4-import data F9-expand F10-contract Esc-exit

```

Figure 5 XY Plotter Sub-section Window

```

=====
||          BULK DATA  CtrlAlt for NOTEPAD
||
|| Ctrl11 Geometry Definition
|| Ctrl12 Element Connections
|| Ctrl13 Properties & Materials
|| Ctrl14 Mass
|| Ctrl15 Sets & Constraints
|| Ctrl16 Loads
|| Ctrl17 Miscellaneous (EIGR,DYNRED,DMI,PLOTEL)
||
=====
|| A:\NASTRAN.                      Line 30  Col 1  Insert  Indent
||SUBCASE 1
|| DISP=ALL
|| ELFORCE=ALL
|| SPCFORCE=ALL
|| OLOAD=ALL
||BEGIN BULK
||
||ENDDATA
||/*
||//NS.FT04F001 DD SYSOUT=4
=====
F1-help F2-save F3-new file F4-import data F9-expand F10-contract Esc-exit

```

Figure 6 Bulk Data Menu

```

=====
|      PROPERTIES & MATERIALS  CtrlAlt for NOTEPAD  PgDn/PgUp  Scroll  |
|      |      |      |      |      |      |      |      |      |      |      |
| PBAR,PID,MID,A,I1,I2,J,NSM,,+PB1  $ Shear stiffnesses are (K1)AG & (K2)AG |
| +PB1,C1,C2,D1,D2,E1,E2,F1,F2,+PB2 $ Form Factor K          Section |
| +PB2,K1,K2,I12                    $ .8333                  Rectangular |
|                                     $ .90                   Solid Circular |
|                                     $ .50                   Thin-walled Circular |
| PROD,PID,MID,A,J,C,NSM            $ Shear stress = C*Moment/J (defines C) |
| PSHELL,PID,MID1,T,MID2,12*I/T**3,MID3,TS/T,NSM,+PS |
| +PS,Z1,Z2,MID4                    $ For plane strain analysis, MID2 = -1 |
|                                     |
|=====
|      A:\NASTRAN.                  Line 30  Col 2  Overwrite Indent  |
| SUBCASE 1 |
| DISP=ALL |
| ELFORCE=ALL |
| SPCFORCE=ALL |
| OLOAD=ALL |
| BEGIN BULK |
| |
| $PSHELL,PID,MID1,T,MID2,12*I/T**3,MID3,TS/T,NSM,+PS |
| $+PS,Z1,Z2,MID4                    $ For plane strain analysis, MID2 = -1 |
| //NS.FT04F001 DD SYSOUT=4 |
|=====
| F1-help F2-save F3-new file F4-import data F9-expand F10-contract Esc-exit |

```

Figure 7 Properties and Materials Window

```

=====
|      DMAP  CtrlAlt for NOTEPAD  PgDn/PgUp  Scroll  |
|      |      |      |      |      |      |      |      |      |      |      |
|      SUB-SECTIONS |
|      |      |      |      |      |      |      |      |      |      |      |
| MATRIX OPERATION |
| UTILITY |
| EXECUTIVE OPERATION |
| GENERAL DMAP RULES |
| |
| Default Values Shown for Parameters |
| |
| TYPE=1 Single precision      FORM=2 General rectangular |
| TYPE=2 Double precision     FORM=6 Symmetric |
| |
|=====
|      A:\NASTRAN.                  Line 13  Col 1  Insert  Indent  |
| APP      DISP |
| SOL      63 |
| TIME     5 |
| DIAG     8 |
| |
| CEND |
|=====
| F1-help F2-save F3-new file F4-import data F9-expand F10-contract Esc-exit |

```

Figure 8 DMAP Statements Sub-sections

```

=====
||PARTN    PHI,EM,/, ,PHI1,/0 $ the lowest 25 after deleting 6 rigid body modes ||
||MATGEN,  /ER/6/25/0/1/7/2/3/1/11 $ Row partitioning - select rows 1,9,10,14 ||
||PARTN    A, ,ER/,A, ,/1 $ of A for further processing ||
||MERGE    A11,A21,A12,A22,CP,RP/A/V,Y,SYM=-1/V,Y,TYPE/V,Y,FORM $ ||
||                                                SYM LT 0 - CP is used for RP ||
||                                                SYM GE 0 - CP & PR are distinct ||
||MERGE,   , , ,ES,/KAA/-1/2/6 $ Form symmetric null double precision ||
||                                                $ matrix of size the length of ES ||
||MERGE,   ,PHIA, , ,RP1/1/2/2 $ Expand PHIA to g size where PHIA has only ||
||                                                $ components 126 - RP1={1.,1.,0.,0.,0.,1.,...repeating sequence} ||
||TRNSP    A/X $ ||
||DIAGONAL A/B/C,Y,OPT=COLUMN/V,Y,POWER=1 $ OPT=COLUMN,SQUARE,WHOLE ||
||READ     KAA,MAA, , ,DYNAMICS, ,CASECC/LAMA,PHIA,MI,DEIGS/MODES/S,N,NEIGV $ ||
||DUMMOD1  GPL,EQEXIN,USET,LAMA,PHIX,MXX, ,/ , , , , ,/NTERMS $ KE requires link ||
=====
r A:\ZOFF.CTL Line 15 Col 1 Insert Indent
||TIME 5 ||
||DIAG 8,14 ||
||$MATGEN, /ER/6/25/0/1/7/2/3/1/11 $ Row partitioning - select rows 1,9,10,14 ||
||$PARTN A, ,ER/,A, ,/1 $ of A for further processing ||
||CEND ||
||TITLE=MSC/NASTRAN CASE1 - QUAD4 ZOFF CHECK ||
=====
F1-help F2-save F3-new file F4-import data F9-expand F10-contract Esc-exit

```

Figure 9 DMAP Statements Window

```

=====
|| 4. DMAP - Modes & Kinetic Energy ||
|| ||
||BEGIN $ ||
||GP1 GEOM1,GEOM2,/GPL,EQEXIN,GPDT,CSTM,BGPDT,SIL/S,N,LUSET/0/ ||
|| S,N,NOGPDT $ ||
||GP4 CASECC,GEOM4,EQEXIN,SIL,GPDT,BGPDT,CSTM/ , ,USET,ASET/LUSET/ ||
|| S,N,MPCF1/S,N,MPCF2/S,N,SINGLE/S,N,OMIT/S,N,REACT/S,N,NSKIP/ ||
|| S,N,REPEAT/S,N,NOSET/S,N,NOL/S,N,NOA/C,Y,SUBID $ ||
||INPUTT2 /K,M, , ,/-1/11 $ (K & M from Rigid Format 3) ||
||MATPRN K,M, , ,// $ ||
||READ K,M, , ,DYNAMICS, ,CASECC/LAMA,PHIA,MI,DEIGS/MODES/S,N,NEIGV/1 $ ||
||OFF DEIGS,LAMA, , , ,// $ ||
||COND FINIS,NEIGV $ ||
||MATPRT PHIA// $ ||
||DUMMOD1 GPL,EQEXIN,USET,LAMA,PHIA,M, ,/ , , , , ,/8 $ ||
||LABEL FINIS $ ||
=====
r A:\ZOFF.CTL Line 15 Col 1 Insert Indent
||CEND ||
||TITLE=MSC/NASTRAN CASE1 - QUAD4 ZOFF CHECK ||
||SUBTITLE=MODAL ANALYSIS ||
||ECHO=BOTH ||
=====
F1-help F2-save F3-new file F4-import data F9-expand F10-contract Esc-exit

```

Figure 10 DMAP Program Window



## APPENDIX A SETTING UP THE APPLICATION DISKETTE

Instructions for setting up the application diskette so that the program will run as described in the section on using the application are given here. The complete application can be placed on a single diskette. For a hard disk system the application components can be arranged similarly.

To make the diskette self booting format it with the system parameter s. Also copy the ANSI.SYS file from the DOS disk. Keep the programs and data files organized by using subdirectories for Sidekick, Superkey, the JCL card files, and a communications program. The contents of the application diskette should look like this.

A:\	A:\SK	A:\KEY	A:\CARDS	A:\COMM
-----	-----	-----	-----	-----
AUTOEXEC.BAT	SK.COM	KEY.COM	JCL1.CRD	communications
IBMBIO.COM		AIDE.MAC	JCL2.CRD	program
IBMDOS.COM			JCL3.CRD	
COMMAND.COM			JCL4.CRD	
ANSI.SYS			JCL5.CRD	
CONFIG.SYS			...	
NASTRAN				

To load Sidekick and Superkey and display the main menu automatically the AUTOEXEC.BAT file should contain the following statements:

```
echo off
cd\key
key
cd\sk
sk
cd\key
key aide/ml
cd\
```

The root directory A:\ will then be the default directory and can be used for NASTRAN data decks. The ANSI.SYS file is needed by Superkey and is installed on start up if the CONFIG.SYS file is present and contains the line: DEVICE=ANSI.SYS.

Before copying Sidekick to the disk two things should be done to prepare SK.COM. First, run Sidekick and from the main menu select the Setup option. On the setup screen under Notefile enter NASTRAN for the Name and A:\ for the Directory. Save by pressing F4. Sidekick will now automatically read in the NASTRAN file when the NOTEPAD option is first selected. This file can act as a bulletin board prior to data deck generation.

Next, run the Sidekick program SKINST.COM, if you want to change the maximum file size of NOTEPAD. The default size is 8000 bytes which will hold about 180 lines. I use NOTEPAD to edit the macro file, AIDE.MAC, which is currently 729 lines (32355 bytes). I have it set to 40000. Use the size you anticipate needing up to 50000.

The Superkey program, KEY.COM, will also need to have it's maximum file size set with KEYINST.COM. Default size is 8000 bytes - maximum size is 60000. I use 40000 presently.

The JCLi.CRD files will depend on the mainframe in use and the job requirements. There are many communications programs available for the PC. All of the files listed above have now been mentioned. Other utility programs can be added. Neither of the help files for Sidekick and Superkey have been included because of disk space limitations. The necessary help may be placed in the macro file.

## APPENDIX B WRITING THE SUPERKEY MACRO

The elements of the Superkey language which have been used to develop the macro file AIDE.MAC are listed here. See Reference 2 for a complete discussion of macros.

<BEGDISP><ShftF1>	Begin display macro for key ShftF1
<BEGDEF><Alt1>	Begin keyboard macro for key Alt1
<ENDDF>	End macro
<TITLE>MAIN MENU<TITLE>	Associates macro key definition with a title in an auxiliary window (accessed by AltPrtsc)
<CTRLD>MAIN MENU<CTRLD>	Yellow foreground (border color)
<CTRLB>ShftF1<CTRLB>	White background/Black foreground
<AUTO>	Autostart a macro (used for MAIN MENU)
1 1 78 10.	Define display window (upper left corner at (1,1), 78 columns, and 10 rows

The display macro for the main menu reads like this:

```
<BEGDISP><ShftF1> 1 1 78 12. <TITLE>MAIN MENU<TITLE><AUTO>
<CTRLD>    MAIN MENU    NASTRAN AIDE - GENERAL INSTRUCTIONS<CTRLD>
<CtrlB>ShftF1<CtrlB> Main Menu    <CtrlB>Esc    <CtrlB>Exit Menu
....
....
<CtrlB>ShftF10<CtrlB> NOTEPAD Commands
<ENDDF>
```

Figure 1 shows the display resulting from these statements (except for color).

A keyboard macro for reading a JCL card file has the following form:

```
<BEGDEF><Alt1><TITLE>JCL1<TITLE><CtrlK>RA:\CARDS\JCL1.CRD<ENTER>
<ENDDF>
```

CtrlKR is the command for reading a DOS file into NOTEPAD and A:\CARDS\JCL1.CRD is the pathname of the file to be read.

Superkey macros can be edited in NOTEPAD or an ASCII word processor. Since the length of macro lines can exceed the default right margin setting, reset the margin before editing these lines in NOTEPAD or some strange things may happen. Set the margin with CtrlOR and enter 180.