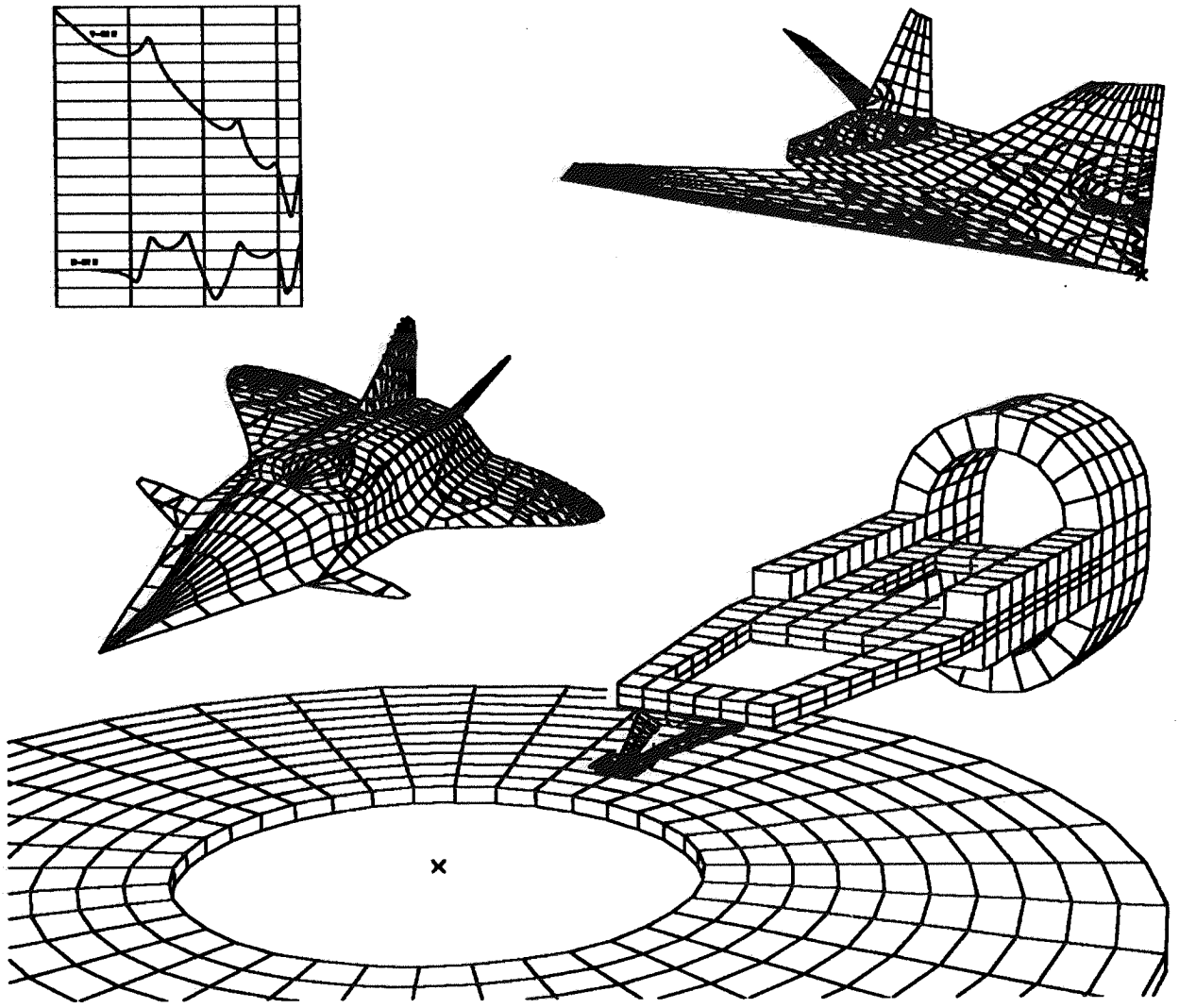
CAE Dialogs for MSC/NASTRAN

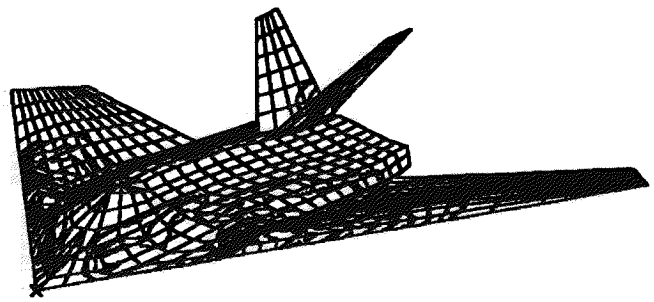
Darryl G. Chong **Salvatore M. Vicari**

IBM Corporation
General Products Division
San Jose, California



1989 MSC/NASTRAN World User Conference

Los Angeles, California
March 13-17, 1989



Preface

The CAE Dialogs described herein include a number of enhancements in development at time of publication. These improvements are:

1. Multiple profiles to save job features.
2. Added data saved for each profile:
   a. Description, input file name, model size, analysis type.
   b. Postprocessing steps for OUTPUT2 files and output plots:
      - Create Universal files from OUTPUT2 files.
      - Create CAEDS model file from Universal files.
      - Create GDF plot file from NASTRAN plot file.
      - Print IBM 3800 plots from GDF plot file.

Conference Edition

Presented at the 1989 MSC/NASTRAN World User Conference, March 13-17, 1989 at the Sheraton-Universal Hotel in Los Angeles, California.

CAE Dialogs for MSC/NASTRAN

Darryl G. Chong **Salvatore M. Vicari**

IBM Corporation
General Products Division
San Jose, California 95193

Abstract

Finite-element analysis is becoming increasingly widespread in engineering design as general-purpose programs have become more available. However, further improvements in ease-of-use are still needed for many popular finite-element analysis codes. This paper describes the CAE[1] Dialog environment for MSC/NASTRAN[2] developed for the IBM-MVS host at the IBM General Products Division in San Jose, California. The interactive dialogs use the ISPF/PDF[3] Program Product to enable the analyst to communicate to MSC/NASTRAN through a set of user-friendly panels, or screens, displayed to the computer terminal. The dialogs illustrate how the required tasks can be simplified, for programs that require both a formatted input file and job stream control[4] for batch job submission. To create the input data stream, selections from a library of data macros are interactively merged into the input file by menu selection. This library is customized to solution requirements of the local user community. Dialog panels are used to select job features and define input-output files for MSC/NASTRAN execution, preprocessing, and postprocessing tasks. The selections are stored in a job profile, from which the job stream is automatically created. By making MSC/NASTRAN easier to set up and execute, less prior computer knowledge is required. Application utilities are provided for printing, plotting, program interfaces, file management, job status, and output review. An on-line news facility and user forum provide for convenient dissemination of application news and encourages communication among users remotely located from one another. By creating similar sets of ISPF dialogs for related CAE analysis software, a fully integrated environment is presented to the engineering analyst.

---

1 Computer-Aided Engineering (CAE).

2 MSC/ is a registered trademark and service trademark of The MacNeal-Schwendler Corporation. NASTRAN is a registered trademark of the National Aeronautics and Space Administration. MSC/NASTRAN is an enhanced, proprietary version developed and maintained by The MacNeal-Schwendler Corporation.

3 Interactive System Productivity Facility/Program Development Facility (ISPF/PDF) is an IBM Program Product.

4 For IBM-MVS computers, the job stream control is called Job Control Language (JCL), which directs the operating system in handling of applications programs.

Introduction

A primary factor inhibiting greater use of batch finite-element programs, such as MSC/NASTRAN, has been their ease of use, or lack thereof. This perception persists despite the significant strides in recent years in preprocessing and postprocessing programs, such as CAEDS[5]. A significant amount of time can still be spent setting up proper sequences of control card images, entering reams of formatted data, and creating associated job stream for batch execution. This intimidates potential users from attempting to use such programs, since many mechanical engineers are either poor typists or inexperienced at using the computer for mechanical analysis.

In lieu of an interactive user-interface provided by MSC/NASTRAN, a set of screen dialogs has been implemented for the IBM-MVS host at the General Products Division of IBM in San Jose, California. These dialogs have been integrated into a common CAE Dialog structure that was developed to suit the primary analysis programs. The concept of the interface is to provide convenient means for:

- MSC/NASTRAN control and input data creation;
- Job-stream setup (Job Control Language) for batch execution;
- Job status and browse functions;
- File editing and catalog management;
- Access to local MSC/NASTRAN utilities;
- Application news and user forum.

The primary focus of the dialogs is to assist new users, although experienced analysts can also benefit from the facility. Class instruction with the dialogs demonstrates that the time required for novice users to successfully generate initial MSC/NASTRAN runs is significantly reduced compared to prior methods. This allows engineers to devote more time developing simulation skills, and less time learning proper MSC/NASTRAN protocol, host commands, and job-stream control. Interactive access is provided to a library of examples and standard data macros of MSC/NASTRAN control and input data, which can be merged into the input data stream. A utility panel is provided to group those utility tools related to MSC/NASTRAN. Finally, an application news facility and user forum provide simple means for dissemination and exchange of information, and consequent elimination of paper.

[5] CAEDS is a registered trademark of IBM Corporation.

Description

The CAE Dialog program is written in IBM CLIST[6] Language to create interactive dialogs, through which the user communicates with the program. The ISPF/PDF Program Product is used to create the CAE Dialogs, which consist of screens, panels, or menus displayed to a text terminal. The primary CAE selection screen, shown in Figure 1, displays the primary mechanical analysis codes on the host installation. The common bridge among the various solvers and CAE programs is provided by CAEDS, which also includes modules for design, finite-element graphics, and linear structural analysis. By installing both solvers and tools for preprocessing and postprocessing on a common host, the simulation process is streamlined for the analyst.

```
CAE ---------------------- COMPUTER-AIDED ENGINEERING ----------------------
OPTION  ===> 2
                <<<<<<<  C A E     Revision 1.0  >>>>>>>

   1  CAEDS       - Finite-Element (FE) Modeler, Solver, Postprocessor
   2  MSC/NASTRAN - Linear and Nonlinear FE Solver for Structural Analysis
   3  OTHERFEM    - Linear and Nonlinear FE Solver for Structural Analysis
   4  LOCALFEM    - Linear FE Solver for Structural Analysis

   5  PLASTFEM    - Flow and Heat Transfer for Plastic Flow
   6  HEATFEM     - Heat Transfer and Fluid Flow Analysis
   7  CATIA?      - 3-D Design System
   8  VIEW        - Graphics Display and Query Facility

   U  Utilities   - CAE News, Print, Send, Receive, Table Functions
   I  ISPF        - ISPF and Selected ISPF Functions
  ST  STATUS      - Display Job Status or Output
```

Figure 1. Primary CAE Selection Screen

Engineers access the selection screen from TSO, as a Data Communication System[8] selection, or from the ISPF command line (= = = >). Once MSC/NASTRAN is selected, the primary menu is presented, as in Figure 2 on page 4. Selections unique to MSC/NASTRAN are the Build and Edit functions. The Build function automates the creation of job-stream control for program execution, which defines input-output files, and preprocessing and postprocessing tasks. The Edit function includes a MERGE feature, which enables the input file to be quickly constructed from an on-line library of data macros for executive control, DMAP[9] sequences, case control, plotting requests, parameters, material properties, complete examples, or even JCL utility procedures.

---

[6] CLIST is a command procedure of executable sequences of TSO commands. TSO is a time sharing system that allows use of the IBM-MVS computer as a terminal.

[7] CATIA is a registered trademark of Dassault Systems.

[8] Data Communication System is an IBM Program Product.

[9] Direct Matrix Abstraction Programming (DMAP) is the data block oriented language used by MSC/NASTRAN.

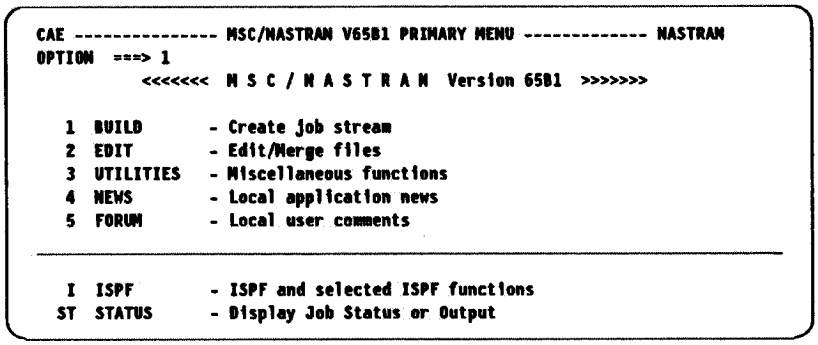


Figure 2. MSC/NASTRAN Primary Menu

The remaining selections are identical for each application, consisting of utilities, news, user forum, ISPF functions for file editing and management, and a Status function for checking on job status, browsing, or printing job output. The modularity of the software allows the dialogs to be easily extended and customized to other CAE analysis tools.

Job Build

To build the job stream required to execute MSC/NASTRAN, the Build option in Figure 2 is selected. This initiates the Job Features selection screen in Figure 3.

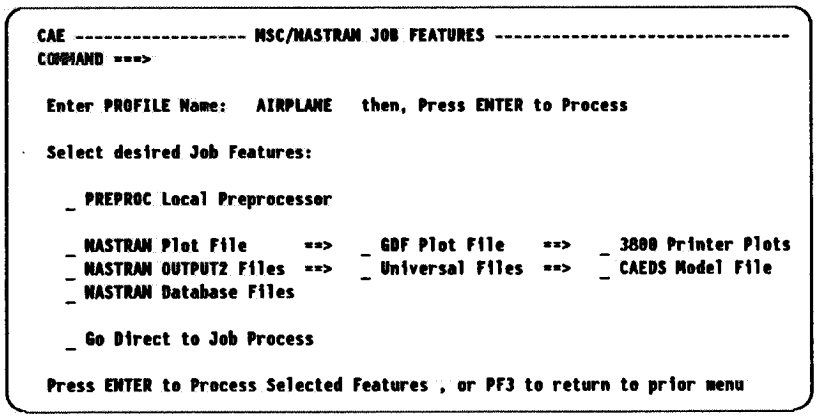


Figure 3. Job Features Selection Screen

A Profile is associated with the set of job features to permit profile recall or modification. A new profile name is entered to create a profile initialized with program defaults. If the profile name is left blank, a selection list of stored profiles is presented. Selected features can include a local preprocessor, output plots, OUTPUT2 files, database files, and postprocessing tasks. If no features are selected, default files are allocated for output plots, OUTPUT2 data, and temporary database.

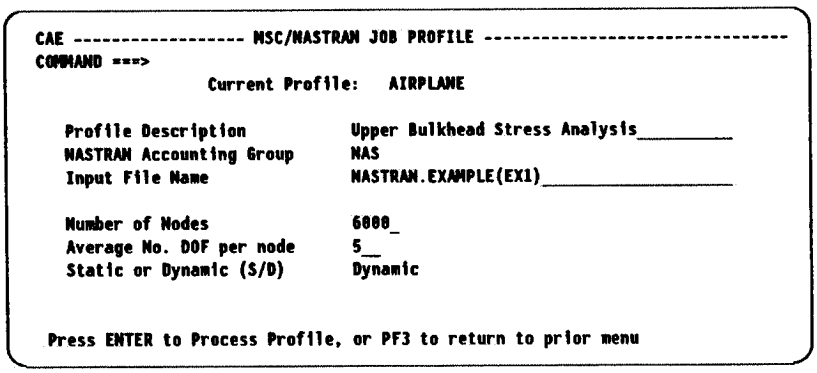


Figure 4. Job Profile Panel

After selecting or entering the profile name, the Job Profile panel is displayed, as in Figure 4. This panel defines the profile description, accounting group, input file name, model size, and analysis type. The model size and analysis type will be used in future enhancements to optimize default values for job card and execution parameters, and file size for new output files. The program returns to the job features screen in Figure 3 on page 4, but now displays features associated with the current profile. Once desired features are selected, subpanels are sequentially displayed and processed for each selected feature, including that for the local preprocessor. The subpanels for defining OUTPUT2 and database files are described in Appendix A.1 and A.2, respectively.

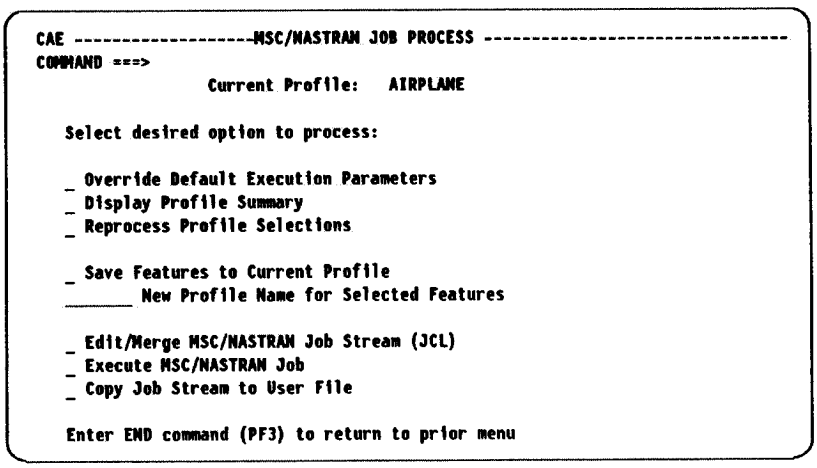


Figure 5. Job Process Panel

After processing the subpanels, the job card parameters are set up. An optional selection is provided to override default execution parameters (region, workspace file size, step time, etc.). This completes the profile definition, which is then displayed in a summary format. Using the job process panel in Figure 5, the profile is saved to the current or new profile name, or reprocessed for further modification of features. At this point, the

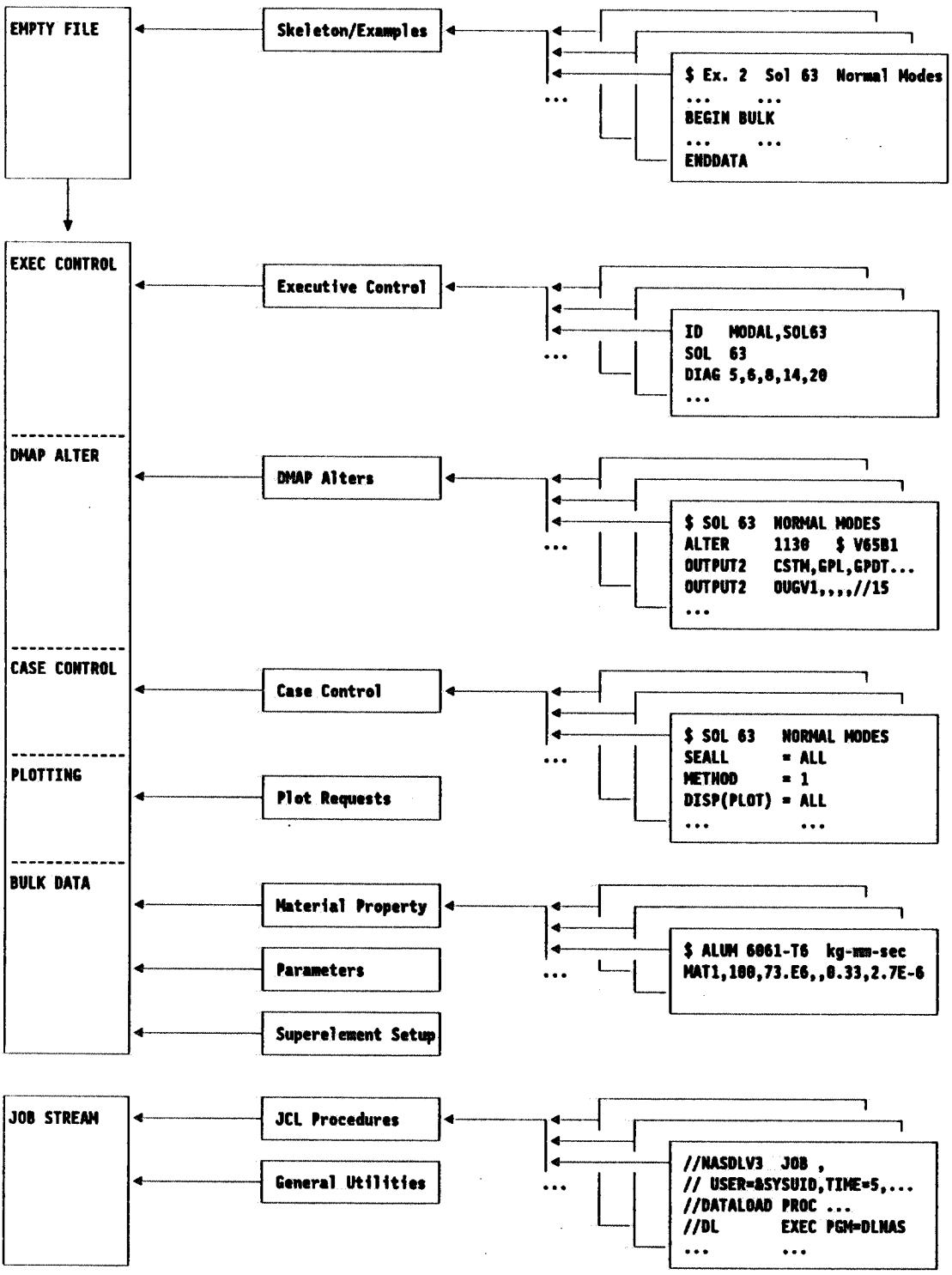


Figure 6. Example of Tree Structure for MERGE Feature

MSC/NASTRAN job is ready for batch execution. However, experienced users are allowed to edit the job stream, or copy to another file for further customizing. Included in the edit function is the ability to merge instream procedures or utilities from a library into the job stream (refer to next section). One advantage of allowing job-stream editing is that the analyst learns the required job control syntax in due time, given the individual motivation.

Edit/Merge Input File

The data entry or initial setup of the input data stream is usually a difficult or tedious task, particularly for less experienced users. One must either decipher the user manuals for several weeks or obtain input examples from other analysts. A common problem is that such code is not current, particularly for DMAP sequences. To resolve this problem, a MERGE feature has been incorporated to complement the file edit process.

The MERGE feature provides ready access to a library of standard macros of various types of MSC/NASTRAN input data, through a two-level tree structure diagrammed in Figure 6 on page 6. Such macros, consisting of commonly used sets of input data, are interactively merged into the input file at a specified location. A centralized support team maintains and updates the library of data macros and coordinates development of new macros with users.

```
CAE ------------ MSC/NASTRAN PRIMARY MERGE SELECTION ------------ ROW 1 OF 18
COMMAND ===>                                                SCROLL ===> HALF
Enter "S" for the function selection list.
CMD                      DESCRIPTION                          MEMBER
---     ------------------------------------------------------ --------
S''     MSC/NASTRAN Input Format (Skeleton and Examples)       A1FORM00
'''     Job Stream for Examples                                B1BJCL00
'''     Executive Control                                      C1EXEC00
'''     - DMAP Sequences:  OUTPUT for CAEDS Data Loader        D1DMAP00
'''     Case Control                                           F1CASE00
'''     - NASTRAN Plotter                                      N1PLOT00
'''     Bulk Data                                              K1BULK00
'''     . . .                                                  . . .
```

Figure 7. Primary MERGE Selections

To invoke the MERGE command, the user first selects the Edit option, shown in Figure 2 on page 4, and enters a new or existing input file name. If desired, Merge can also be used with the ISPF Edit option in the dialogs. Once in the Edit mode, the user enters MERGE at the command line. An *A* or *B* is entered alongside the desired line, for *after* or *before*; otherwise, the macro is inserted at the top of the file. This initiates the primary merge selection menu, shown in Figure 7. After selecting *MSC/NASTRAN Input Format*, the list of available data macros is displayed (Figure 8 on page 8).

```
CAE ------------ MSC/NASTRAN INPUT FILE MERGE SELECTION -------- ROW 1 OF 75
COMMAND ===>                                          SCROLL ===> HALF
Input selection for:  MSC/NASTRAN INPUT FORMAT (SKELETON AND EXAMPLES)

        B = browse          C = copy into your data stream
CMD                         DESCRIPTION                          MEMBER
---     ------------------------------------------------------- --------
 C      MSC/NASTRAN Input Format - Skeleton                      A1FORM01
 _      Ex. 1  - Sol 61:  Static Analysis of Cantilevered Plate  A1FORM20
 _      Ex. 2  - Sol 63:  Normal Modes of Cantilevered Plate     A1FORM21
 _      Ex. 3  - Sol 71:  Restart of Ex 2 - Modal Freq. Response A1FORM22
```

Figure 8. Example Selections under NASTRAN Input Format

Subtopics can be browsed by entering a *B*, or copied into the input file by entering *C*, alongside the selected item. In the example above, the user first copies a skeleton of the input format to an initially empty file, producing the merged file, shown in Figure 9. The process is continued for other major topics, as shown in Figure 10 on page 9 for Executive Control, until the basic input data stream has been created. The input data is completed by copying into the bulk data section the MSC/NASTRAN formatted file from CAEDS FEM Graphics. Finally, the standard data macros are customized, if required, so that set, load, or constraint references match those in the bulk data. Class instruction with the combined merge and job build features has shown new users can execute initial runs within 30 minutes, and less if started by merging a complete example into the input file.

```
EDIT ---- A123456.NASTRAN.EXAMPLE(EX1) - 01.00 ---------- COLUMNS 001 072
COMMAND ===> MERGE                                    SCROLL ===> HALF
****** ******************************** TOP OF DATA ********************************
000001 NASTRAN
000002 $  MSC/NASTRAN INPUT FORMAT - SKELETON                        FORMAT
A 0003 $====== E X E C U T I V E   C O N T R O L ==============================
000004 $
000005 $------------ DMAP SEQUENCES ----------------------------------------
000006 $
000007 CEND
000008 $====== C A S E   C O N T R O L ========================================
000009 $
000010 $-------------- PLOT OUTPUT REQUESTS ---------------------------------
000011 $
000012 $====== B U L K   D A T A ==============================================
000013 BEGIN BULK
000014 $
000015 $
000016 ENDDATA
```

Figure 9. Result after Merging Input Format Skeleton

```
EDIT ---- A123456.NASTRAN.EXAMPLE(EX1) - 01.00 ---------- COLUMNS 001 072
COMMAND ===>                                              SCROLL ===> HALF
****** ******************************** TOP OF DATA ********************************
000001 NASTRAN
000002 $  MSC/NASTRAN INPUT FORMAT - SKELETON                          FORMAT
000003 $====== E X E C U T I V E   C O N T R O L ========================
000004 $                                                             EXECUTIVE
000005 $  SOL 63 - SUPERELEMENT NORMAL MODES                           CONTROL
000006 $                                                             C1EXEC41
000007 IB      MODEL,COMPONENT
000008 APP     DISP
000009 SOL     63
000010 DIAG    5,6,8,14,20
000011 TIME    120
000012 $
000013 $------------ DMAP SEQUENCES ----------------------------------------
000014 $
000015 CEND
```

Figure 10. Result after Merging Executive Control

A FORMAT command was created to further assist bulk data creation. This command operates while in Edit mode, and copies the MSC/NASTRAN bulk data format into the input file, as a guide for bulk data entries. The formats are copied from the MSC/NASTRAN file, NASTRAN.DEMO(UM24), and inserted before or after the designated line. An example is shown in Figure 11, followed by the resulting file in Figure 12. If the search characters are appended with an asterisk (e.g., MAT*, QUAD*), all formats with the search string in columns 1 to 8 are inserted.

```
EDIT ---- A123456.NASTRAN.EXAMPLE(EX1) - 01.00 ---------- COLUMN 001 072
COMMAND ===> FORMAT MAT8                                  SCROLL ===> HALF
****** ******************************** TOP OF DATA ********************************
000128 $====== B U L K   D A T A ==============================================
000129 BEGIN BULK
A 0130 $
000131 MAT8    100     ?       ?       ?
```

Figure 11. Initiating the Format Command

```
EDIT ---- A123456.NASTRAN.EXAMPLE(EX1) - 01.00 ---------- COLUMN 001 072
COMMAND ===>                                              SCROLL ===> HALF
****** ******************************** TOP OF DATA ********************************
000128 $====== B U L K   D A T A ==============================================
000129 BEGIN BULK
000130 $
000131 $MAT8   MID     E1      E2      NU12    G12     G1,Z    G2,Z    RHO
000132 $       A1      A2      TREF    XT      XC      YT      YC      S
000133 $       GE      F12
000134 MAT8    100     30.E6   10.E6   0.3                             2.7E-6
```

Figure 12. Input File After Copying in Desired Format

Utilities

Utilities related to MSC/NASTRAN are grouped under the Utilities option, as shown in Figure 13. Selections could include utility tools for printing or viewing of MSC/NASTRAN plots, data converters to translate plots to standard graphics formats, or routines to communicate to postprocessing graphics programs, such as CAEDS.

```
CAE ---------------------------- UTILITIES ------------------------- NASTRAN
OPTION  ===>

   1  PLOT        - Display NASTRAN Plots on 3277GA Workstation
   2  CONV GDF    - Create GDF Plot File from NASTRAN Plot File
   3  VIEW GDF    - View GDF Plots on 5080/3279/PC/PS (GDQF)
   4  PRINT GDF   - Print GDF Plots on 3800/3812/3820 Printer
   5  INTERACTIVE - Interactive CAEDS Data Loader
   6  . . .
```

Figure 13. MSC/NASTRAN Utilities Menu

General utilities useful for all CAE analysis programs are grouped under the Utilities option on the primary CAE selection screen shown in Figure 1 on page 3. These utilities include a general news facility, and local functions for file print, file receive, file send to selected users, job output copying to a file, and electronic mail.

News and Forum

An application news facility provides convenient means for disseminating past and current items of interest. A news function is created for each application, so that information on a given CAE program is readily located. The facility allows users to browse individual items or print to local printers. News items are written into a single partitioned dataset. The selection list is constructed in order of their member name (i.e., INFO0640), as shown in Figure 14.

```
NASTRAN ---------------------------- NEWS FACILITY -------------- ROW 1 OF 26
COMMAND ===>                                                 SCROLL==> PAGE
  Enter:      "B" to browse an entry     "P" to print an entry.

  OPT    DATE       TABLE OF CONTENTS
  ---    ---------------------------------------------------------------------
   _      8-14-87  CAE Dialog User-Interface for MSC/NASTRAN          INFO0010
   _      6-30-88  MSC/NASTRAN Vers. 65B and 65B1 Enhancements       INFO0600
   _     11-16-87  Finite Element Test Results                       INFO0640
   _      9-07-88  NASTRAN User Problems/Resolution                  INFO0700
   _     11-10-88  Documentation                                     INFO0890
   _     12-22-88  Assistance                                        INFO0900
```

Figure 14. MSC/NASTRAN News

Similarly, a user forum allows local users to share information on problems or modeling techniques. One can add, browse, print, or even edit an entry to allow another user to reply to a given problem. Each new or edited entry is automatically transmitted to an application administrator, so that problems can be addressed immediately. New entries cause the display of a selection list of application users, so that copies can be electronically sent to selected or all users. The forum facility is shown in Figure 15.

```
NASTRAN ------------------------- FORUM FACILITY -------------- ROW 1 OF 13
COMMAND ===>                                                  SCROLL==> HALF
  Enter:      'A' to ADD a new entry      'P' to PRINT an entry
              'B' to BROWSE an entry      'E' to EDIT an entry.

 OPT   Date       Entry Description
 ---   ---------------------------------------------------------------------
  _    88/03/01   Nonlinear Buckling Analysis Techniques              INF09995
  _    88/02/07   Managing Databases for Superelement Analysis        INF09996
  _    88/01/17   CAEDS Program Files for NASTRAN Superelement Data   INF09997
  _    88/01/27   Problems with PUGVX Matrix Generation               INF09998
  _    87/12/20   LANCZOS Eigenvalue Solution Method                  INF09999
  _    87/10/16   Sample Forum Entry                                  STARTER
```

Figure 15. MSC/NASTRAN Forum

ISPF Functions

To address requirements for general file editing and file management, selected ISPF functions are available in the primary CAE selection screen, shown in Figure 1, and in the primary menu for each application (e.g., Figure 2). This panel is shown in Figure 16 on page 12, and lists the ISPF functions that satisfy requirements for 95 percent of analyst activities. This contrasts to the standard ISPF menu (not shown), which is available as option 0. New users appreciate not having to recall the specific suboption number to perform daily tasks. However, proficient users can enter I.6 to go direct to the catalog function, or even I.0.4.7 for foreground-linkage editor. The dialog selections are programmed to use the standard ISPF/PDF Program Product; hence, the functions require minimal coding. If desired, local utility functions can be coded and added to the selection list, as shown by the OFTEN option in Figure 16 on page 12.

Status

Job status functions are provided by a general purpose utility (SDSF command) for:

- Checking on job activity;
- Canceling jobs;
- Browsing current job output during or after execution;
- Changing job class (active, held, or output class).

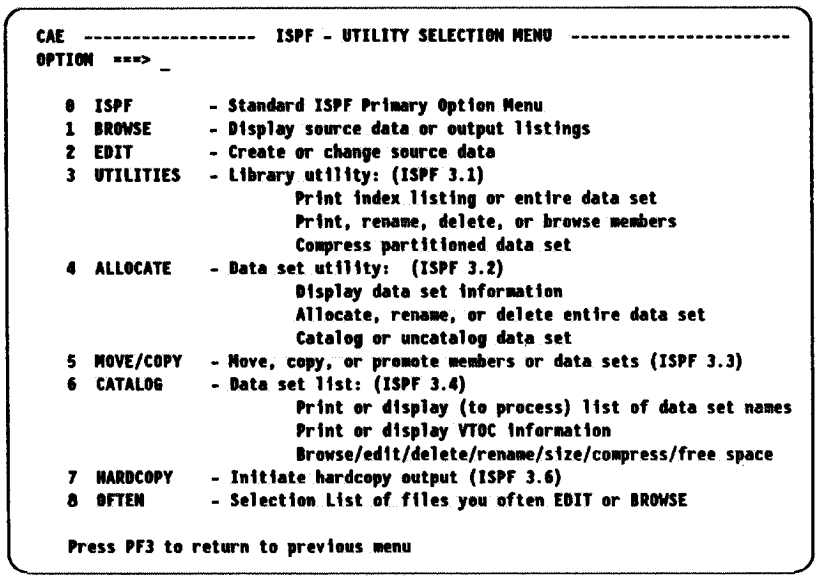


Figure 16. ISPF and Selected ISPF Functions

As with any other TSO command, this function could be executed directly by entering TSO SDSF at the command line on any dialog panel.

Conclusions

The CAE Dialog interface developed for MSC/NASTRAN demonstrates one approach to enhancing the ease-of-use for existing analysis programs. The modularity of the dialogs permits its extension to other CAE analysis software. This provides for commonality in user interface, regardless of application. The approach offers benefits to both novice and advanced users. In the case of job-stream control, which can initially be intimidating to non-programmers, the dialogs allow for transparent creation. Yet, one can browse or edit the created job stream; this also teaches users improved methods for manually setting up or modifying job-stream control for unique situations. Similarly, the ordinary edit function is enhanced with the ability to insert, or merge, macros of control or input data selected from a central on-line library. This provides users with easy access to fully operating examples and standard setups for various solution types, serving to educate users quickly. Although successful execution of MSC/NASTRAN can still be non-trivial at times, even after generation of job control and input data has been made easy, the dialog interface has proven popular since its inception among new users and existing users.

Appendix

A.1 Subpanel for OUTPUT2 Files

In the job build activity, subpanels are processed to define the detailed requirements for each selected profile feature. The subpanel in Figure 17 allows up to twelve OUTPUT2 files to be defined, corresponding to FORTRAN UNITS 15, 16, 17, . . . , 26 referenced in the OUTPUT2 statements in the DMAP sequences. Each file is provided a default size, which advanced users can override by entering the desired primary and secondary extents in cylinders (e.g., 100 , 20). With the IBM-MVS operating system, up to sixteen extents (including the primary) can be used for a single file. The Release (RLSE) parameter is used when the file is created. This parameter frees unused file space and returns it to the operating system.

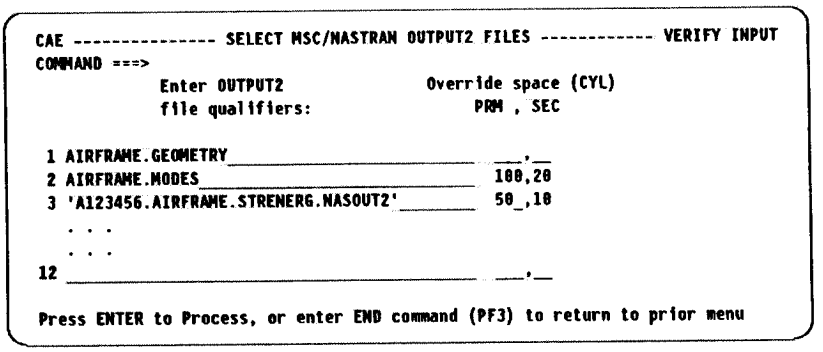


Figure 17. Subpanel for Definition of OUTPUT2 Files

If a fully qualified (within single quotes) file name is not entered, the USERID is assumed as the prequalifier and NASOUT2 for the postqualifier. Normally, the OUTPUT2 files are newly created for each run. If an existing name is specified, the file is re-created with the default file size or with desired space in cylinders. Alternatively, a file can be reused by responding to a program warning that the file will otherwise be deleted and re-created.

A.2 Subpanel for Database Files

Database files are specified by the subpanel in Figure 18 on page 14. If a permanent database is not desired, a temporary file is automatically created, since a database is required for solution sequences (Sol 61 to 99). Up to twelve database files can be specified. As future requirements dictate, the dialogs could easily be modified to allocate OUTPUT2 or database files to specific volumes. The database files are normally concatenated to appear as a single large database by the NASTRAN command line. Database files are prequalified and postqualified by the USERID and NASDB, respectively, unless the file name is entered fully qualified. In a similar fashion, output plot files are

appended with the postqualifier NASPLOT. Although any database file can be defined for new data, the DB01 file is generally used, with other databases assigned for data generated earlier. Two reasons for using the DB01 file for new data are:

- The DMAP command DBMGR is not required to establish a new database in DB01;
- The database is searched from the top of the stack of concatenated files; hence, the desired matrix or data block first encountered is the most recent version.

Because a sequence of MSC/NASTRAN runs often involves addition of a new DB01 file to the database stack, the database file names can be conveniently shifted down or up one line at a time, by entering *D* or *U* at the *shift files* line. The DBSET 1 parameter on the NASTRAN card defines which database files are to be concatenated as a single file; whereas, the DBSET 15 parameter specifies which databases are to be *read only*. An example of such a NASTRAN card is shown below:

```
NASTRAN  DBSET 1=(DB01 , DB02 , DB03 , DB04), DBSET 15=(DB02 , DB03 , DB04)
```

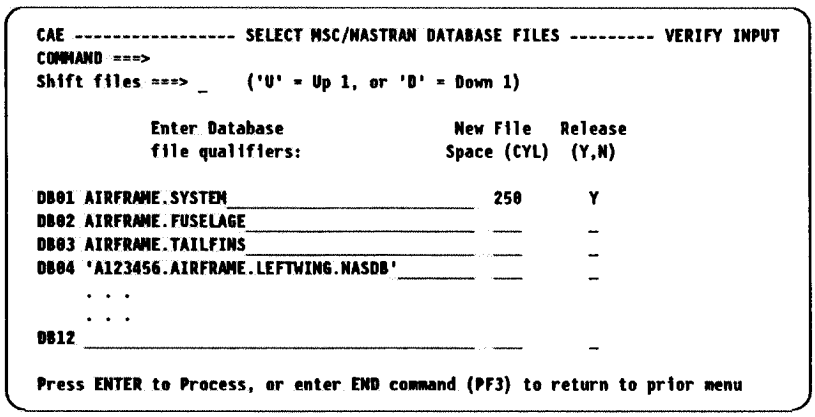


Figure 18. Subpanel for Defining Database Files for Solution Sequences

To allocate a new database, the desired file name is entered. A default file size is assumed, unless the new file space in cylinders is entered. If the Release option is selected, the database is allocated at execution time, and unused space is returned to the operating system. To reuse a set of database files, only the desired file names need be entered. No secondary extent is specified, since Version 65 and prior releases of MSC/NASTRAN require the entire database be in the primary extent, and that the database file be contiguous. This is because data blocks are accessed randomly, but organized sequentially within. This requires certain data blocks be contiguous. Although many finite-element models may run successfully without specifying the contiguous parameter, problems sometime occur when a very large database is required. In this event, there is less likelihood that the database will be contiguous. Implementation of a fully relational database structure for future versions of MSC/NASTRAN would hopefully eliminate requirements for a contiguous database in the primary extent.