

# INTERNAST: A GATEWAY TO MSC/NASTRAN

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## 1.0 ABSTRACT

INTERNAST is a user-friendly preprocessor to MSC/NASTRAN. For engineers, it relieves the burden of knowing complicated operating system commands. Also, no prior knowledge is necessary to generate the File Management Section (FMS) newly added in MSC/NASTRAN. INTERNAST helps to save engineering hours and computer dollars by reducing the probability of execution errors.

INTERNAST generates appropriate Job Control Language commands to execute MSC/NASTRAN in a batch mode (currently on CRAY). The FMS commands generated by INTERNAST at user's discretion, are automatically inserted at their respective proper locations in the MSC/NASTRAN input deck.

The advanced features such as Split Database Technology of superelements, multiple databases (DBALL), automatic restart in different solution sequences, DMAP-ALTER libraries, etc., are very efficiently handled by INTERNAST, sparing the engineer's time mainly for engineering work. It also scans for errors in user input, pre-empting the costly execution runs doomed for fatal termination.

## 2.0 INTRODUCTION

INTERNAST is an interactive program designed to facilitate the execution of MSC/NASTRAN. A user may select options for an MSC/NASTRAN run and then have INTERNAST submit the run. The modifiable parameters found in INTERNAST allow the user to partially modify the input deck, select file-handling, and submit batch MSC/NASTRAN runs. The INTERNAST system works in a front-end/back-end configuration, where INTERNAST executes on the front-end machine and MSC/NASTRAN executes on the back-end machine. (The front-end and back-end may be the same machine.)

The parameter requests in INTERNAST have been structured for ease of use. This is achieved through the use of separate feature sections, a help utility and descriptive prompts for specific information. Defaults are supplied for all but the required parameters.

The purpose of INTERNAST is to minimize the amount of work required of an MSC/NASTRAN user to execute MSC/NASTRAN once the bulk data deck, the case control deck and the executive deck have been created. INTERNAST will assemble necessary job control language cards to execute MSC/NASTRAN with the proper file-handling. The FMS section of MSC/NASTRAN Version 66 is created by INTERNAST based on the user's parameter inputs. The generated FMS deck is then automatically inserted into the MSC/NASTRAN input deck at the proper location with the proper syntax.

INTERNAST is structured into several main sections of input parameters, involving overall job control, executive directives and file-handling. Each division has its own list of modifiable parameters. These parameters may be saved to a permanent file and used at a later time. This saves time in reentering data when several analyses are similar.

Refer to Figure 1 for a graphical representation of the INTERNAST environment.

# INTERNAST ENVIRONMENT

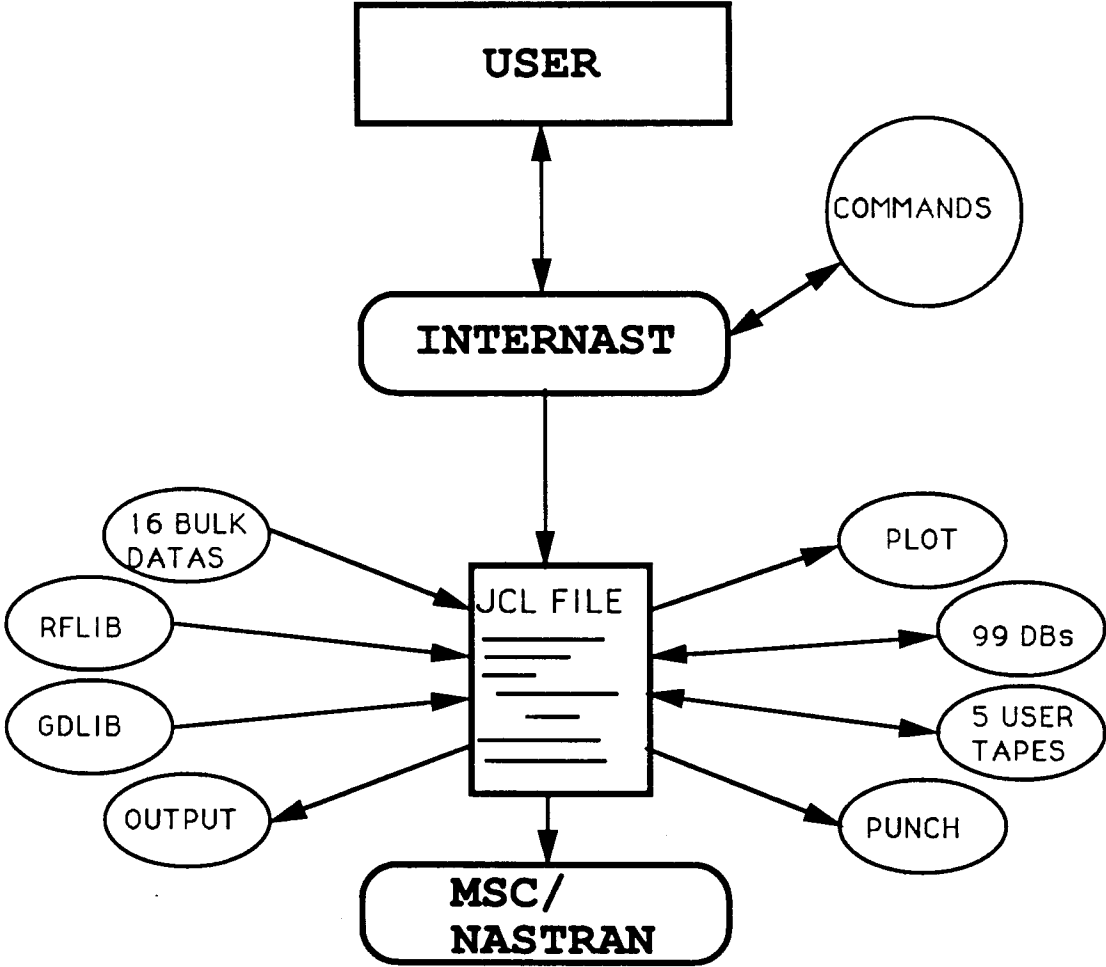


Figure 1.

### 3.0 PROBLEM DEFINITION

Many engineers using MSC/NASTRAN are not familiar with or do not want to be bothered with knowing the operating system commands that drive their job. They prefer to spend their time on engineering analysis. There is also an element of human error that frequently may cause an MSC/NASTRAN job to assess a fatal error due to incorrect operating system command syntax. Nor do many engineers particularly care on which computer their MSC/NASTRAN job runs, as long as it's done in a reasonable time at a reasonable cost, and the results are easily accessible. Syntax errors and the learning of operating system commands may be an unnecessary expense of time that may be better spent.

What if there were a method by which this process of running an MSC/NASTRAN job were automated so that only a minimal amount of operating system commands need be entered?-where the MSC/NASTRAN job ran on the quickest, least expensive back-end computer available, yet allowed the user to edit files on a friendlier front-end machine?-that handled machine-to-machine interface transparently to the user? These tasks are the reason INTERNAST was created.

### 4.0 USER'S SPECIFICATIONS FOR INTERNAST

INTERNAST was written to incorporate many user-friendly capabilities. Its major emphasis is on the generation of non-engineering-type file management-related card images needed for the MSC/NASTRAN deck structure of Version 66A. INTERNAST creates system-required job control language cards based on the user input. INTERNAST follows the user's specifications summarily listed here.

4.1 The File Management Section (FMS) of MSC/NASTRAN Version 66 and onward should be completely generated by INTERNAST at the discretion of the user.

4.2 The FMS cards generated by INTERNAST should automatically be inserted between the user-supplied MSC/NASTRAN statement (if any) and the user-supplied Case Control Section of the input file. Hierarchy of the FMS cards, as specified by MSC/NASTRAN, should be properly maintained by INTERNAST during the insertion.

- 4.3 The files generated through DMAP and NDDL should be saved by INTERNAST the same as those generated by the structured and unstructured solution sequences (e.g., MASTER, DBALL, Split database files, etc.). This is for future use.
- 4.4 The new procedure of using Rigid Format Alters (RFALTER) given in the MSC/NASTRAN User's Manual, Version 66A, November 1989, should be incorporated in INTERNAST Version 66. Also, the user-supplied alters on private libraries should be automatically inserted in the MSC/NASTRAN deck, following the user input of INTERNAST commands.
- 4.5 INTERNAST should offer the migration aid procedure to convert a Version 65 database to a Version 66 database set.
- 4.6 INTERNAST should allow both INTERNAST Version 65 and INTERNAST Version 66 to be called from a single driver.
- 4.7 INTERNAST should implement Split Database technology for minimum effort on the part of the user using superelements. This should include FMS creation and insertion into the MSC/NASTRAN input deck and creation of job control language.
- 4.8 To harness the advantages of the User Delivery Databases, INTERNAST should have a provision to utilize them on the user's command. This option will be incorporated when these databases are available at General Dynamics.
- 4.9 NASTRAN Version 66 generates a number of files such as DAT, DBALL, F04, F06, LOG, MASTER, etc. INTERNAST should have a user option to save any or all of these files.
- 4.10 INTERNAST should reasonably check all user input for syntax errors, inconsistencies, etc., and report them immediately to the user. MSC/NASTRAN execution should not be initiated on detection of any error.
- 4.11 INTERNAST should have the capability to read and write a file of INTERNAST commands (in addition to accepting each command interactively). This would allow for ease of use when using repetitive commands. It should also make the INTERNAST session almost instantaneous.

4.12 INTERNAST-generated FMS card images and job control language, along with the remainder of the MSC/NASTRAN input deck, should be automatically submitted by INTERNAST to the computer execution queue in batch mode and/or in interactive execution mode, if available.

## 5.0 INTERNAST MAIN MENU ITEMS

INTERNAST is structured into several main sections of input commands. Each division has its own list of commands with modifiable parameters. The following list outlines the major types of information for which INTERNAST will prompt.

- 5.1 Login information for back-end machine
- 5.2 Job setup information, including: MSC/NASTRAN input deck name, output filename desired, field length, time required
- 5.3 Rigid format alters to be inserted into the input deck. The user would enter the alter identifier (e.g., rf24d74), and INTERNAST would accordingly format the MSC/NASTRAN invocation statement and would extract the requested alter from a CRAY alter library and insert it into the proper position in the MSC/NASTRAN input deck.
- 5.4 Usertape files to be saved or accessed
- 5.5 Various output files to be saved: plot, punch
- 5.6 User-supplied job control language statements to be inserted into jobstream job control language
- 5.7 Split database choices that will cause the appropriate instructions to be inserted into the MSC/NASTRAN input deck and the corresponding job control language to be inserted in the jobstream job control language.
- 5.8 FMS commands: choices corresponding to each of the eleven FMS commands may be entered (ACQUIRE, ASSIGN, DBCLEAN, DBDIR, DBFIX, DBLOCATE, ENDJOB, EXPAND, INIT, PROJ, RESTART). These will cause the appropriately-formatted FMS commands to be inserted into the input deck and the

corresponding job control language to be inserted in the jobstream job control language.

## 6.0 EXAMPLES OF INTERNAST EXECUTION

The input file or command file of INTERNAST is generated through the interactive session. The file can be on the machine where MSC/NASTRAN is to be executed. In many cases, and INTERNAST session is on a different machine, and the output file of INTERNAST is routed to the MSC/NASTRAN input queue. The examples listed here are for the latter scenario in which INTERNAST is executed on a CYBER computer and MSC/NASTRAN on a CRAY computer, using the CRAY operating system (COS).

### 6.1 NASTRAN Coldstart Run

This run needs the following interactive commands:

```
INPUT,NASIN
USERINFO
USERNAME,ABCDEF
USERPASSW,ABCDEF
RETURN
RUN
```

The first command gives the file name (e.g., NASIN) where MSC/NASTRAN input is stored. The second through fifth commands give the user's CRAY account number and password, which are needed to interact with the CRAY. The RUN command starts execution of INTERNAST. MSC/NASTRAN on the CRAY is automatically executed, and the relevant databases (DBALL, MASTER, output, F04, etc) are catalogued on the default machine specified by INTERNAST. In fact, INTERNAST can catalogue the databases on any connected machine desired by the user.

### 6.2 NASTRAN Restart Run

The following interactive INTERNAST commands will perform the restart of the run given in section 6.1 above.

```
INPUT,NASINR
FMS
```

```
RESTART,ID=NASIN
RETURN
USERINFO
USERNAME,ABCDEF
USERPASSW,ABCDEF
RETURN
RUN
```

MSC/NASTRAN restart input file is NASINR. Databases are from the most recent run of the NASIN file. FMS command helps the interactive user generate the RESTART command by guiding the user in a question/answer session, if the user selects to do so.

An error in any command such as RESTART will be immediately reported by INTERNAST. In case there is no error, MSC/NASTRAN restart run will be automatically executed on the appropriate machine (e.g., CRAY), and the relevant databases, output, etc., will be saved as in the coldstart run.

### 6.3 Multiple Dbsets for DBALL

This is a very useful feature in MSC/NASTRAN. In the following INTERNAST input, a request is made to divide the database into two physical files: DBALL1 and DBALL2. INTERNAST prompts the user through the FMS commands: INIT and ASSIGN, and from these inputs, INTERNAST generates and inserts the necessary FMS commands and job control language.

```
INPUT,NASIN
FMS
ASSIGN,DBALL1=DBALL1
ASSIGN,DBALL2=DBALL2
INIT,N,DBALL,LOGICAL=DBALL1,DBALL2
RETURN
USERINFO
USERNAME,ABCDEF
USERPASSW,ABCDEF
RETURN
RUN
```

The database created in the above run is used in the following restart run.



```
INPUT,NASINR
FMS
RESTART,ID=NASIN
RETURN
ATTACH,DBALL1,NASIN
ATTACH,DBALL2,NASIN
USERINFO
USERNAME,ABCDEF
USERPASSW,ABCDEF
RETURN
RUN
```

INTERNAST guides the user through FMS,RESTART and ATTACH commands and correspondingly creates and inserts the necessary FMS commands and job control language.

#### 6.4 Reading an INTERNAST Command File

This is a useful feature of INTERNAST. Consider that the user wants to make many restart runs of section 6.2 above. Assume that the user has saved the interactive commands listed there in a file (e.g., INCOM). The user only needs to enter one command to initiate the restart run:

```
READFILE,INCOM
```

INTERNAST will then perform the following operations automatically:

- a. read the commands from the file
- b. create required FMS card images
- c. insert the corresponding correctly-formatted FMS cards at their proper locations in the MSC/NASTRAN input deck
- d. generate job control language that will perform file-handling and drive the MSC/NASTRAN job on the back-end computer, which is the MSC/NASTRAN-resident computer (CRAY in this example)
- e. submit the MSC/NASTRAN job to the execution queue (or execute MSC/NASTRAN interactively, as the case may be)
- f. route the database, output, F04, etc., files to the user-desired location

- g. stop INTERNAST execution after step d, if any errors are detected up through that step. Inform the user of the error.

## 6.5 Other Examples

Similar examples are available for split database, data migration, restart and other capabilities to be used in NASTRAN with the help of INTERNAST.

## 7.0 SYSTEMS ON WHICH INTERNAST IS AVAILABLE AND FUTURE PLANS

- 7.1 Front-end: APOLLO SR10.2  
(running INTERNAST Version 66)  
Back-end: CRAY UNICOS Version 5.1.10  
(running MSC/NASTRAN Version 66B)  
(In development)
- 7.2 Front-end: CYBER NOS Version 2.7.1  
(running INTERNAST Version 66)  
Back-end: CRAY COS Version 1.17.2  
(running MSC/NASTRAN Version 65A)
- 7.3 Front-end: CYBER NOS Version 2.7.1  
(running INTERNAST Version 65)  
Back-end: CRAY COS Version 1.17.2  
(running MSC/NASTRAN Version 65A)
- 7.4 Front-end: CYBER NOS Version 2.5.3  
(running INTERNAST Version 65)  
Back-end: CYBER NOS Version 2.5.3  
(running MSC/NASTRAN Version 65)

### FUTURE PLANS

- See User's Specifications Sections 4.3 and 4.8.
- Implementation on other machines on an as needed basis.
- Updates in INTERNAST as per changes in NASTRAN versions.

- Future changes responsive to user suggestions as experience grows.

## 8.0 CONCLUSIONS

INTERNAST frees much of the engineers' time for engineering work, rather than requiring time-consuming, error-prone, computer-oriented activity. MSC/NASTRAN software users can get beyond the mundane mechanics of their MSC/NASTRAN job and concentrate on analyzing the results of their job. The automation of repetitive operating-system and computer-to-computer interface protocol and the elimination of much human error will save time and expense. INTERNAST allows engineers to quicken the pace of their finite element analysis advances.

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