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NASA Technical Memorandum 109053

PATRAN 2.5/EAL Interface Guide

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(NASA-TM-109053) PATRAN 2.5/EAL INTERFACE GUIDE (NASA) 49 p

N94-27655

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G3/61 0000305

February 1994

National Aeronautics and
Space Administration
Langley Research Center
Hampton, Virginia 23681-0001

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INTRODUCTION

PATRAN/EAL INTERFACE GUIDE

The PATRAN/EAL interface consists of two programs, EALPAT, a program which will translate an EAL (ref. 1) database into PATRAN 2.5 neutral and results files, and PATEAL, a program which will translate a PATRAN 2.5 (ref. 2) database into an EAL runstream. This documentation will describe the capabilities of these two programs and give instructions for using them.

SUMMARY

The PATRAN/EAL interface guide describes two programs, EALPAT and PATEAL. EALPAT reads an EAL L01 file and translates the model and results into a PATRAN 2.5 neutral file, element results file, and nodal results file. An EAL model can be color coded in PATRAN, and geometry, loads, boundary conditions, section and material properties, rigid masses, springs, and beam orientations can be plotted and debugged. EAL results can be brought into PATRAN as element or nodal quantities and displayed as deformed plots, animated shapes, color coded elements, or color filled contour plots. PATEAL converts a PATRAN 2.5 database into an EAL runstream. Complex models can be generated and debugged interactively within PATRAN and then output into a complete EAL runstream for a static analysis. Geometry, including all element types, alternate coordinate systems, material properties, section properties, loads and boundary conditions are all converted. EALPAT and PATEAL can also be used together with the PATNAS translator from PDA Engineering to convert an EAL runstream to an MSC/NASTRAN bulk data file. Since both EALPAT and PATEAL use database access routines to access the EAL and PATRAN 2.5 databases, they operate very efficiently and require very little special preparation from the user.

EALPAT

The EALPAT program uses EAL database access routines (ref. 3) to read an EAL L01 file (ref. 4) and output a PATRAN neutral file and various PATRAN result files. EALPAT can be used for several purposes:

1. Translate an EAL model into Patran neutral file format.

This option allows a user to debug an EAL model developed outside of PATRAN. Nodes, elements, material data, property data, coordinate frames, constraints, concentrated mass, nodal and element temperatures, nodal and element pressures, and nodal forces are read from the EAL L01 file and output to a PATRAN neutral file. This option may also be used to convert an EAL runstream to a NASTRAN bulk data file by using the MSC/NASTRAN translator (ref. 5) with the neutral file generated by EALPAT.

2. Translate EAL results into PATRAN results files.

This option reads an L01 file and writes stress, strain, temperature, force, and deformation data to PATRAN results files. This allows a user to use the interactive and color capabilities of PATRAN to view EAL results.

The Main Menu

The EAL library being translated should be stored in a file named L01. When you have entered the EALPAT program, the EALPAT logo appears with the most recent program modification date. The menu shown below is displayed after the completion of each selected operation.

MAIN MENU--EAL TO PATRAN TRANSLATOR

1. TRANSLATE MODEL------------------------------	GEOM.PAT
2. TRANSLATE DISPLACEMENTS---------------	DISP.PAT
3. TRANSLATE ELEMENT STRESSES-----------	ESTR*i*.PAT
4. TRANSLATE AVERAGE NODAL STRESS----	NSTR*i*.PAT
5. TRANSLATE ELEMENT CENTER STRAIN---	ESTRN.PAT
6. TRANSLATE VIBR MODE SHAPE-------------	VIBR.PAT
7. TRANSLATE BUCK MODE SHAPE------------	BUCK.PAT
8. TRANSLATE NODAL PRESSURES-------------	GEOM.PAT
9. TRANSLATE NODAL FORCES-----------------	GEOM.PAT
10. TRANSLATE EQNF FORCES-------------------	GEOM.PAT
11. TRANSLATE REACTIONS---------------------	REAC.PAT
12. TRANSLATE NODAL TEMPERATURES------	NTEMP.PAT
13. TRANSLATE STATIC TEMPERATURES------	STEMP.PAT
14. TRANSLATE TRANSIENT TEMPERATURES	TTEMP.PAT
15. TRANSLATE ELEMENT TEMPERATURES---	ETEMP.PAT
16. USER INTERFACE	
17. X/Y PLOTTING------------------------------------	PLOT.TEM and PLOT.XYD
18. HELP and UPDATE INFORMATION	
0. END	

SELECTION: >

Definition of Options -- Main Menu

1. TRANSLATE MODEL-----------GEOM.PAT

This option directs EALPAT to translate the EAL nodes, elements, material, and property data into PATRAN neutral file packets (ref. 2) which are written on a file named GEOM.PAT. The following EAL datasets are the only ones read from the L01 file with this option:

ALTR BTAB -------- coordinate frames translated into packet 5
JDF1 BTAB --------- read to determine NDOF in problem
JLOC BTAB -------- node data translated into packet 1
MATC BTAB ------- material properties translated into packet 3
MREF BTAB ------- beam orientation data translated into packet 2
CON ----------------- constraint data translated into packet 8
BRL BTAB --------- beam offset data translated into packet 2
BA BTAB --------- beam properties translated into packet 4
BB BTAB -------- beam properties translated into packet 4
BC BTAB --------- beam properties translated into packet 4
BD BTAB --------- beam properties translated into packet 4
SA BTAB ---------- shell properties translated into packet 4
SB BTAB ---------- shell properties translated into packet 4
PROP BTAB -------- solid properties translated into packet 4
RMAS BTAB ------- rigid mass data translated into packet 2
GD xxxx ----------- read to set up element type and group counters
DEF xxxx ----------- element definition data translated into packet 2
Exx OFFS ---------- beam offset data translated into packet 2

If the model size limits exceed the maximum number of nodes or elements allowed by EALPAT, an error message is generated and the model is not translated. To view the current model size limits of EALPAT, use the "PROGRAM LIMITS" option under the HELP menu. (This is selection 18 of the EALPAT main menu.) Property and material numbers will be translated for the elements, but certain guidelines must be used. PATRAN stores the material number only on the property card; therefore, each property card must be unique. This is already required by EAL for SA tables. For example, if there are two .5 inch thick elements made of different materials, EAL requires two SA entries. To translate material numbers correctly into PATRAN, this requirement would also apply to all other property entries. If there were two rectangular bar elements made of different materials, there should be two entries in the BA table.

The model option sets up node and element counters that are used in the stress and deformation translations, so it must always be the first option chosen. If any other option (other than the HELP menu) is chosen, EALPAT will write an error message, and ask the user to choose the model option first. After the model option is chosen, the following prompts appear:

INPUT TITLE CARD:

This title will be used as the title card for the neutral and results files.

INPUT NUMBER OF CONSTRAINT CASES:

Only the number of cases chosen will be written to the neutral file and all others will be ignored.

OUTPUT GROUPS AS NAMED QUANTITIES ? (Y or N):

If the EAL user has only used one group and element type in the EAL model, the N option should be chosen to save time and file space. If there is more than one element type or if multiple groups exist in the EAL model, choosing Y will cause each element type and group to be written as a named quantity on the neutral file. These names are in the form ExxGX, SxxGX, FxxGX, KxxGX, and CxxGX, where xx indicates the element type and X represents the group number. For example, group 5 of the E43 elements would be written as the named quantity E43G5. The PATRAN user can then use these names to plot the model by groups in order to verify the model, animate mode shapes, or view result contours. The PATRAN user references these names with the active set commands. For example to plot only E43 group 5, type the following commands within PATRAN:

SET, ACTIVE, NONE
DRAW, E43G5

Before exiting, the translate model option will write messages indicating the number of joints, elements, alternate reference systems, constraint cases, property cards, rmass entries, and named quantities written to GEOM.PAT.

Using EALPAT to convert EAL to MSC/NASTRAN

Since most model data can be read into PATRAN with the neutral file format, and a PATRAN to MSC/NASTRAN translator is available from PDA Engineering (ref. 5), EALPAT can be used to convert an EAL runstream to a MSC/NASTRAN bulk data file. EALPAT was written to have a compatible element configuration code with MSC/NASTRAN elements (refer to TABLE 1), so that EAL elements will be translated to their most compatible MSC/NASTRAN element. Property cards would have to be translated by the user since the format of the property data stored on the neutral file is analysis code dependent.

2. TRANSLATE DISPLACEMENTS-------------DISP.PAT

This option converts EAL static displacements to the PATRAN nodal results file DISP.PATXCx, where X refers to the load set number and x indicates the load case number. When this option is chosen, the following prompts appear:

INPUT LOAD SET NUMBER:

INPUT CONSTRAINT CASE NUMBER:

INPUT TOTAL NUMBER OF LOAD CASES TO BE READ:

INPUT SUBTITLE 2 OR BLANK (CR):
(this prompt will appear for each load case)

The load set, constraint set and load case numbers are written as subtitle 1 on DISP.PATXCx.

Static displacement data should be stored in global coordinates on the L01 file in the data set PATR DISP. To convert static displacements to global coordinates within EAL, execute the following commands: (ref. 2)

***XQT AUS**
DEFINE SD=STAT DISP
PATR DISP=LTOG(SD)

If you have not used alternate coordinate systems, you may just rename the STAT DISP data set to PATR DISP with the following commands in EAL:

***XQT DCU**
CHANGE 1 STAT DISP 1 1 , PATR DISP 1 1

3. TRANSLATE ELEMENT STRESSES----------ESTR*i*.PAT

This option converts EAL element stresses to the PATRAN element results file ESTR*i*.PATXCx, where *i* refers to B for bar elements, P for plate elements, and S for solid elements, and XCx indicates the load set and case number. The element stress option is useful for viewing center of the element stress using element assignment plots (RUN, ASSIGN option within PATRAN). ***This is the only option available for plotting stresses in bar elements.*** When the user chooses the element stress option, the following prompt appears:

WHICH STRESS DATA SETS ?

1. **GSF**
2. **ES**
3. **ES -- SR**
4. **ES -- SL3C**

SELECTION: >

The EALPAT user has the option of reading the element stress data from either the STRS xxxx datasets generated by the GSF processor in EAL, or the ES xxxx datasets generated by the ES processor. ***The ES processor is recommended.***

GSF Processor

GSF stores forces and moments in the STRS xxxx datasets. (ref. 3) EALPAT uses this data and the flexibility coefficients read from the SA BTAB datasets in order to calculate stress values. Therefore, both STRS xxxx and SA BTAB must be stored on the L01 file in order to translate element stress data generated by GSF.

ES Processor

If the user generates stresses with the ES processor, the stresses must be saved on the L01 file by using the OUTLIB=1 command within the ES processor. EALPAT will read stress data from three different output types, ES (the default in EAL), SR (stress resultants), and SL3C (stress data for laminate elements). The EAL user chooses a stress type other than the default for ES with the OUTPUT TYPE = SR (or SL3C) command within the ES processor. The user must also indicate the element type and group number. The "ALL" option cannot be used in EAL if the stresses are to be translated by EALPAT. EAL stores data by group in the ES datasets. There are EALPAT program limits on how many elements can exist within a group for ES stress translation. If the user exceeds these limits, an error message will be generated, and the stresses will not be translated for that particular group. To view the current limit on number of elements per group for each element type, choose the "PROGRAM LIMITS" option under the HELP menu. (Selection 18 in the main menu of EALPAT) For E21 elements, the NPE21 reset parameter must be left at the default value 2.

Both Processors

After choosing the GSF or ES stress datasets, the user is asked to input the load set and load case numbers for stress translation. The following prompts appear:

INPUT LOAD SET NUMBER:

INPUT TOTAL NO. OF LOAD CASES TO BE TRANSLATED:

After selecting the load set and load case numbers, the user is asked to input the element type for stress translation:

INPUT ELEMENT TYPE FOR STRESS TRANSLATION:

1. **Bar element**
2. **Plate element**
3. **Solid element**
4. **Laminate plate element**

SELECTION: >

Only one of these four element types may be selected at a time since the element result file column data is different for the various element types. If the user had previously selected the ES SL3C datasets, this prompt would not appear. The user is then asked to input a joint number for stress output for GSF and the default ES output type datasets:

INPUT JOINT NUMBER FOR STRESS OUTPUT

"1"--"8"	**for joint number of element**
"9"	**for center of the element**

SELECTION: >

This option will allow the user to view any data that appears in an EAL output with PATRAN. In most cases, the user should choose "9" for center of the element stress. Since only the center of the element results are calculated for SL3C and SR datasets, this prompt does not appear. If the user has chosen a laminate plate element for the element type selection or chosen the SL3C datasets, it is necessary to choose a layer for stress translation.

INPUT LAMINATE LAYER FOR STRESS OUTPUT:

If the user has chosen a plate element for stress results, the following menu will appear:

INPUT SURFACE FOR STRESS TRANSLATION:

1. **Z = 0 (mid-surface)**
2. **Z = T/2**
3. **Z = -T/2**

SELECTION: >

This refers to the same data format output by EAL. (Refer to EAL Users Manual page 7.1-8.) If the user has chosen a solid element for stress results, the following menu will appear:

INPUT COORDINATE SYSTEM FOR STRESS RESULTS

1. **GLOBAL SYSTEM (EAL RESULTS ARE CONVERTED)**
2. **LOCAL SYSTEM (EAL RESULTS ARE NOT CONVERTED)**

SELECTION: >

EALPAT will write the load set, load case, surface and layer number on ESTR*i*.PATXCx as subtitle 1. The user will be prompted for subtitle 2 for each load case. This can be left blank if desired.

INPUT SUBTITLE 2 OR BLANK (CR):

The stress data is written on ESTR*i*.PAT.XCx in the following formats:

BAR ELEMENTS (GSF Datasets):

E21:

Column 1:	Maximum combined P/A + bending (tension)
Column 2:	Maximum combined P/A + bending (compression)
Column 3:	P/A
Column 4:	Transverse shear stress, S1
Column 5:	Transverse shear stress, S2
Column 6:	Twist shear
Column 7:	Shear force, end 1, direction 1
Column 8:	Shear force, end 1, direction 2
Column 9:	Axial force, end 1, direction 3
Column 10:	Moment, end 1, direction 4
Column 11:	Moment, end 1, direction 5
Column 12:	Moment, end 1, direction 6
Column 13:	Shear force, end 2, direction 1
Column 14:	Shear force, end 2, direction 2
Column 15:	Axial force, end 2, direction 3
Column 16:	Moment, end 2, direction 4
Column 17:	Moment, end 2, direction 5
Column 18:	Moment, end 2, direction 6

E22

Column 1 - 6:	0.0
Column 7:	Shear force, end 1, direction 1
Column 8:	Shear force, end 1, direction 2
Column 9:	Axial force, end 1, direction 3

Column 10:	Moment, end 1, direction 4
Column 11:	Moment, end 1, direction 5
Column 12:	Moment, end 1, direction 6
Column 13:	Shear force, end 2, direction 1
Column 14:	Shear force, end 2, direction 2
Column 15:	Axial force, end 2, direction 3
Column 16:	Moment, end 2, direction 4
Column 17:	Moment, end 2, direction 5
Column 18:	Moment, end 2, direction 6

E23

Column 1:	Force in element
Column 2:	Stress in element
Column 3-18:	0.0

E24

Column 1:	Axial force at joint 1
Column 2:	Transverse shear force at joint 1
Column 3:	Moment at joint 1
Column 4:	Axial force at joint 2
Column 5:	Transverse shear force at joint 2
Column 6:	Moment at joint 2
Column 7:	Axial stress at joint 1
Column 8:	Shear stress at joint 1
Column 9:	Bending stress on upper surface at joint 1
Column 10:	Bending stress on lower surface at joint 1
Column 11:	Axial stress at joint 2
Column 12:	Shear stress at joint 2
Column 13:	Bending stress on upper surface at joint 2
Column 14:	Bending stress on lower surface at joint 2
Column 15-18:	0.0

E25

Column 1:	Force at joint 1, direction 1
Column 2:	Force at joint 1, direction 2
Column 3:	Force at joint 1, direction 3
Column 4:	Moment at joint 1 about axis 1
Column 5:	Moment at joint 1 about axis 2
Column 6:	Moment at joint 1 about axis 3
Column 7:	Force at joint 2, direction 1
Column 8:	Force at joint 2, direction 2

Column 9:	Force at joint 2, direction 3
Column 10:	Moment at joint 2 about axis 1
Column 11:	Moment at joint 2 about axis 2
Column 12:	Moment at joint 2 about axis 3
Column 13 - 18:	0.0

BAR ELEMENTS (ES Datasets):

E21

Column 1:	PX at joint 1
Column 2:	PY at joint 1
Column 3:	PZ at joint 1
Column 4:	MX at joint 1
Column 5:	MY at joint 1
Column 6:	MZ at joint 1
Column 7:	SZ at joint 1
Column 8:	TZX at joint 1
Column 9:	TZY at joint 1
Column 10:	TZR at joint 1
Column 11:	SZ1 at joint 1
Column 12:	SZ2 at joint 1
Column 13:	SZ3 at joint 1
Column 14:	SZ4 at joint 1
Column 15:	PX at joint 2
Column 16:	PY at joint 2
Column 17:	PZ at joint 2
Column 18:	MX at joint 2
Column 19:	MY at joint 2
Column 20:	MZ at joint 2
Column 21:	SZ at joint 2
Column 22:	TZX at joint 2
Column 23:	TZY at joint 2
Column 24:	TZR at joint 2
Column 25:	SZ1 at joint 2
Column 26:	SZ2 at joint 2
Column 27:	SZ3 at joint 2
Column 28:	SZ4 at joint 2

E22

Column 1:	PX at joint 1
Column 2:	PY at joint 1
Column 3:	PZ at joint 1
Column 4:	MX at joint 1
Column 5:	MY at joint 1
Column 6:	MZ at joint 1
Column 7:	PX at joint 2
Column 8:	PY at joint 2
Column 9:	PZ at joint 2
Column 10:	MX at joint 2
Column 11:	MY at joint 2
Column 12:	MZ at joint 2
Column 13-28:	0.0

E23

Column 1:	Axial Force, Tension Positive
Column 2:	Axial Stress, Tension Positive
Column 3-28:	0.0

E24

Column 1:	P at joint 1
Column 2:	V at joint 1
Column 3:	M at joint 1
Column 4:	SZ at joint 1
Column 5:	TXZ at joint 1
Column 6:	SZ1 at joint 1
Column 7:	SZ2 at joint 1
Column 8:	P at joint 2
Column 9:	V at joint 2
Column 10:	M at joint 2
Column 11:	SZ at joint 2
Column 12:	TXZ at joint 2
Column 13:	SZ2 at joint 2
Column 14:	SZ2 at joint 2
Column 15-28:	0.0

E25

Column 1:	PX at joint 1
Column 2:	PY at joint 1
Column 3:	PZ at joint 1
Column 4:	MX at joint 1
Column 5:	MY at joint 1
Column 6:	MZ at joint 1
Column 7:	PX at joint 2
Column 8:	PY at joint 2
Column 9:	PZ at joint 2
Column 10:	MX at joint 2
Column 11:	MY at joint 2
Column 12:	MZ at joint 2
Column 13 - 28:	0.0

PLATE AND LAMINATE PLATE ELEMENTS (E31 - E44):

Column 1:	SX
Column 2:	SY
Column 3:	TXY
Column 4:	Major principal stress
Column 5	Minor principal stress
Column 6:	Max Shear
Column 7:	Von Mises
Column 8:	EX
Column 9:	EY
Column 10:	EXY
Column 11:	Major principal strain
Column 12:	Minor principal strain

SOLID ELEMENTS (S41 - S81)

Column 1:	SX
Column 2:	SY
Column 3:	SZ
Column 4:	TXY
Column 5:	TYZ
Column 6:	TXZ
Column 7:	Von Mises
Column 8:	Principal Stress S1
Column 9:	Principal Stress S2
Column 10:	Principal Stress S3

4. TRANSLATE AVERAGE NODAL STRESS-------NSTR*i*.PAT

This option converts EAL element stresses to the PATRAN nodal results file NSTR*i*.PATXCx, where *i* refers to B for bar elements, P for plate elements, and S for solid elements, and XCx indicates the load set and case number. ***This option should be used when the user intends to use the color filled contour plot option (fringe plots) within PATRAN.*** This option reads the EAL ES or SLY stress datasets and computes an average nodal stress for plate, laminate plate, and solid elements. For example, if four plate elements share a common node, EAL will calculate a different stress value for the node as it appears in each of the four elements. In this example, the nodal stress option of EALPAT will sum the four stress values calculated for the same node on each element and divide by four to determine an average stress for the node.

This option only reads the ES datasets which have been stored on the L01 file with an OUTLIB=1 command in the ES processor. The user should use the OUTPUT TYPE = SLY to calculate the stress results for laminate plate elements. Each group and element type should be indicated in ES. The "ALL" option in EAL should not be used. Error messages will be given for missing ES data sets if the element geometry for an element type and group appears in the geometry data sets (DEF XXXX) and no ES data set for that particular element type and group has been saved on the L01 file. Ignore this message if you do not intend to plot stress for these elements. When the user chooses this option the following prompts appear:

INPUT LOAD SET NUMBER:

INPUT TOTAL NO. OF LOAD CASES TO BE TRANSLATED:

INPUT LOAD CASE NUMBERS TO BE TRANSLATED:

For example, by responding 2, 2 and 2, 5 to the previous prompts, the EALPAT user will translate only load case 2 and 5 of load set 2. EALPAT will then prompt the user for the element type.

INPUT ELEMENT TYPE FOR STRESS TRANSLATION:

1. PLATE ELEMENT (ES DATASETS)
2. SOLID ELEMENT (ES DATASETS)
3. LAMINATE PLATE ELEMENT (SLY DATASETS)

SELECTION: >

If plate elements are chosen, the following prompt will appear:

INPUT SURFACE FOR STRESS OUTPUT:

1. **Z = 0 (mid-surface)**
2. **Z = T/2**
3. **Z = -T/2**

SELECTION: >

If laminate plate elements are chosen, the user will be prompted for a layer for stress output:

INPUT LAMINATE LAYER FOR STRESS OUTPUT:

EALPAT will write the load set, load case surface and layer number on NSTR*i*.PAT as subtitle 1. The user will be prompted for subtitle 2 for each load case. This can be left blank if desired.

INPUT SUBTITLE 2 OR BLANK (CR):

The average nodal stress data is written on NSTR*i*.PAT.Xcx in the following formats:

PLATE AND LAMINATE PLATE ELEMENTS (E31 - E44):

Column 1: SX
Column 2: SY
Column 3: TXY
Column 4: Major principal stress
Column 5: Minor principal stress
Column 6: Max Shear
Column 7: Von Mises
Column 8: EX
Column 9: EY
Column 10: EXY
Column 11: Major principal strain
Column 12: Minor principal strain
Column 13: Maximum Von Mises stress at the node
Column 14: Minimum Von Mises stress at the node
Column 15: Percent Variation of Von Mises stress at the node (MAX (ABS(Average Von Mises - Maximum Von Mises), ABS(Average Von Mises - Minimum Von Mises))/Average Von Mises) * 100.

SOLID ELEMENTS: (S41 - S81)

Column 1:	Average SX stress at the node
Column 2:	Average SY stress at the node
Column 3:	Average SZ stress at the node
Column 4:	Average TXY stress at the node
Column 5:	Average TYZ stress at the node
Column 6:	Average TXZ stress at the node
Column 7:	Average Von Mises stress at the node
Column 8:	Maximum Von Mises stress at the node
Column 9:	Minimum Von Mises stress at the node
Column 10:	Percent Variation of Von Mises stress at the node (MAX (ABS(Average Von Mises - Maximum Von Mises), ABS(Average Von Mises - Minimum Von Mises))/Average Von Mises) * 100.
Column 11:	Principal Stress S1
Column 12:	Principal Stress S2
Column 13:	Principal Stress S3

5. TRANSLATE ELEMENT CENTER STRAIN-----ESTRN.PAT

This option reads the ESN datasets and outputs element strain information for plate elements (E31-E33 and E41-E43) in PATRAN element results file format. All load set information will be written on a file named ESTRN.PAT.XCx, where X represents the load set number and x represents the load case number. ESN datasets are created in the ES processor of EAL with the statement OUTPUT TYPE=ESN and saved on the L01 file with OUTLIB=1. The user is asked to input the load set and load case numbers for stress translation.

INPUT LOAD SET NUMBER:

INPUT TOTAL NO. OF LOAD CASES TO BE TRANSLATED:

EALPAT will write the load set and case numbers as subtitle 1 on ESTRN.PATXCx. The user is then prompted for subtitle 2 for each load case.

INPUT SUBTITLE 2 OR BLANK (CR):

Element strain data is written to ESTRN.PAT.XCx in the following format:

Column 1: EX -- membrane strain at element center
Column 2: EY -- membrane strain at element center
Column 3: GXY-- membrane strain at element center

Column 4: KX -- bending curvature at element center
Column 5: KY -- bending curvature at element center
Column 6: KXY-- bending curvature at element center

6. TRANSLATE VIBR MODE SHAPE-----------VIBR.PAT

This option reads the vibration mode dataset from the L01 file and writes a PATRAN displacement file named VIBR.PATX for each mode. (X refers to the mode number.) VIBR MODE data should be stored in global coordinates on the L01 file in the data set PATR VIBR. To convert mode vectors to global coordinates within EAL, execute the following commands: (ref. 2)

***XQT AUS**
DEFINE SV=VIBR MODE
PATR VIBR=LTOG(SV)

If you have not used alternate coordinate systems, you may just rename the VIBR MODE data set to PATR VIBR with the following commands in EAL:

***XQT DCU**
CHANGE 1 VIBR MODE 1 1 , PATR VIBR 1 1

When the user chooses this option, the following prompts appears:

INPUT THE OUTPUT DATASET NUMBER:

This number is determined by the N3OUT reset parameter in E4 or the NEWSET reset parameter in EIG.

INPUT CONSTRAINT CASE NUMBER:

INPUT NUMBER OF MODES:

Only the number of modes requested will be translated even though the VIBR MODE dataset may contain more modes. Since the modes are read in ascending order, the user should specify the highest mode number to be plotted in PATRAN. The mode number and frequency in hertz are written as subtitle 1 on the nodal results file VIBR.PATX. The user is then prompted for subtitle 2 for each mode:

INPUT SUBTITLE 2 OR BLANK (CR):

7. TRANSLATE BUCK MODE SHAPE-----------BUCK.PAT

This option reads the bucking mode dataset from the L01 file and writes a PATRAN displacement file named BUCK.PATX for each mode. (X refers to the mode number.) BUCK MODE data should be stored in global coordinates on the L01 file in the data set PATR BUCK. To convert mode vectors to global coordinates within EAL, execute the following commands: (ref. 2)

***XQT AUS**
DEFINE SB=BUCK MODE
PATR BUCK=LTOG(SB)

If you have not used alternate coordinate systems, you may just rename the BUCK MODE data set to PATR BUCK with the following commands in EAL:

***XQT DCU**
CHANGE 1 VIBR BUCK 1 1 , PATR BUCK 1 1

When the user chooses this option, the following prompts appears:

INPUT THE OUTPUT DATASET NUMBER:

This number is determined by the N3OUT reset parameter in E4 or the NEWSET reset parameter in EIG.

INPUT CONSTRAINT CASE NUMBER:

INPUT NUMBER OF MODES:

Only the number of modes requested will be translated even though the BUCK MODE dataset may contain more modes. Since the modes are read in ascending order, the user should specify the highest mode number to be plotted in PATRAN. The mode number and frequency in hertz are written as subtitle 1 on the nodal results file BUCK.PATX. The user is then prompted for subtitle 2 for each mode:

INPUT SUBTITLE 2 OR BLANK (CR):

8. TRANSLATE NODAL PRESSURES-----------GEOM.PAT

This option reads the dataset NODA PRES and writes the nodal pressures on GEOM.PAT in packet 10 format (ref. 2 page 29-23). When this option is chosen the following prompts appear:

INPUT LOAD SET NUMBER:

INPUT NUMBER OF LOAD CASES:

Only one set may be specified, but all cases associated with an EAL load set may be translated. Although packet 10 data refers to temperature rather than pressure data, it is necessary to use this method since EAL relates nodal pressure data only to nodes. The element information which would be required by packet 6 (distributed loads) is not available from the NODA PRES dataset. Since packet 10 refers to temperature data, to view nodal pressure data in PATRAN the user must refer to this data as temperature data. For example, to view nodal pressure data from load case 2, the user would have two choices:

Method 1:

The user would type the following unprompted commands within PATRAN:

RUN,CONTOUR,TEMP,2
RUN,HIDE,F

This method would generate a color filled contour plot of the pressure data.

Method 2:

The user would first enter the ANALYSIS menu of PATRAN and would choose the VERIFY menu. The user would select LOADS/BCS (loads/boundary conditions), and then would select TEMP. For multiple load cases the user would be requested to input the case number of the data he wishes to examine. The user would then have the option of plotting the data or showing the data at individual nodes. If the user chooses to plot the data, the node is circled and the pressure is written beside it.

9. TRANSLATE NODAL FORCES---------------GEOM.PAT

This option reads EAL applied force data from the L01 file and writes it to the PATRAN neutral file, GEOM.PAT, in packet 7 format and on the file FORC.PATXCx in nodal results format. When this option is chosen the following prompts appear:

INPUT LOAD SET NUMBER:

INPUT NUMBER OF LOAD CASES:

Only one load set may be specified, but all load cases associated with an EAL set may be translated.

Applied force data should be stored in global coordinates on the L01 file in the dataset PATR FORC. To convert applied forces to global coordinates within EAL, execute the following commands:

```
*XQT AUS
DEFINE SF=APPL FORC
PATR FORC=LTOG(SF)
```

If you have not used alternate coordinate systems, you may just rename the APPL FORC dataset to PATR FORC with the following commands in EAL:

```
*XQT DCU
CHANGE 1 APPL FORC 1 1 , PATR FORC 1 1
```

10. TRANSLATE EQNF FORCES---------------GEOM.PAT

This option reads EAL equivalent force data from the L01 file and writes it to the PATRAN neutral file, GEOM.PAT, in packet 7 format and on the file FORC.PATXCx in nodal results file format. When this option is chosen the following prompts appear:

INPUT LOAD SET NUMBER:

INPUT NUMBER OF LOAD CASES:

Only one load set may be specified, but all load cases associated with an EAL load set may be translated. Equivalent force data should be stored in global coordinates on the L01 file in the dataset PATR EQNF. To convert applied forces to global coordinates within EAL, execute the following commands:

```
*XQT AUS
DEFINE SE=EQNF FORC
PATR EQNF=LTOG(SE)
```

If you have not used alternate coordinate systems, you may just rename the EQNF FORC dataset to PATR EQNF with the following commands in EAL:

```
*XQT DCU
CHANGE 1 EQNF FORC 1 1 , PATR EQNF 1 1
```

11. TRANSLATE REACTIONS-----------------REAC.PAT

This option reads EAL static reaction data from the L01 file and writes it to a PATRAN nodal results file, REAC.PATXCx, where X represents the load set and x refers to the load case. When this option is chosen, the following prompts appear:

INPUT LOAD SET NUMBER:

INPUT CONSTRAINT CASE NUMBER:

INPUT NUMBER OF LOAD CASES:

Only one load set and constraint case may be specified, but all load cases associated with an EAL load set and constraint case may be translated. Static reaction data should be stored in global coordinates on the L01 file in the dataset PATR REAC. To convert static reactions to global coordinates within EAL, execute the following commands:

***XQT AUS**
DEFINE SR=STAT REAC
PATR REAC=LTOG(SR)

If you have not used alternate coordinate systems, you may just rename the STAT REAC dataset to PATR REAC with the following commands in EAL:

***XQT DCU**
CHANGE 1 STAT REAC 1 1, PATR REAC 1 1

12. TRANSLATE NODAL TEMPERATURES---------NTEMP.PAT

This option reads the dataset NODA TEMP and writes the nodal temperatures on GEOM.PAT in packet 10 format (refer to the PATRAN USERS MANUAL p. 29-23), or on NTEMP.PAT in nodal results file format. When this option is chosen, the following prompt appears:

INPUT NUMBER OF TEMPERATURE CASES:

INPUT FILE TYPE FOR TEMPERATURE DATA:

1. **NEUTRAL FILE (GEOM.PAT)**
2. **RESULTS FILE (TEMP.PAT)**
3. **BOTH**

SELECTION: >

The load set and temperature case numbers will be written as subtitle 1 on NTEMP.PAT. The user will be prompted for a reference temperature and subtitle 2 for each temperature case.

INPUT REFERENCE TEMPERATURE:

INPUT SUBTITLE 2 OR BLANK (CR):

If the temperature data is written on GEOM.PAT, the user would have two methods of plotting the data within PATRAN.

Method 1:

The user would type the following unprompted commands within PATRAN:

RUN,CONTOUR,TEMP,2
RUN,HIDE,F

This method would generate a color filled contour plot of the temperature data.

Method 2:

Enter the ANALYSIS menu of PATRAN.
Choose the VERIFY menu.
Select LOADS/BCS (loads/boundary conditions)
Select TEMP

For multiple load cases the user would be requested to input the case number of the data he wishes to examine. The user would then have the option of plotting the data or showing the data at individual nodes. If the user chooses to plot the data, the node is circled and the temperature is written beside it.

13. TRANSLATE STATIC TEMPERATURES--------STEMP.PAT

This option reads the static temperatures from the L01 file and writes the temperature data on a PATRAN nodal results file, STEMP.PAT. Static temperature data should be stored on the L01 in a dataset STAT TEMP. When this option is chosen, the following prompts appear:

INPUT LOAD SET NUMBER:

INPUT LOAD CASE NUMBER:

INPUT NUMBER OF TEMPERATURE CASES:

The load set and temperature case numbers are written as subtitle 1 on STEMP.PAT. The user is prompted for subtitle 2 for each temperature case:

INPUT SUBTITLE 2 OR BLANK (CR):

14. TRANSLATE TRANSIENT TEMPERATURES-----TTEMP.PAT

This option reads the transient temperatures from the L01 file and writes the temperature data on a PATRAN nodal results file, TTEMP.PAT. Transient temperature data should be stored on the L01 file in a dataset TRAN TIME. The first subtitle on the nodal results file will be the "TEMPERATURE AT TIME = XXXX". When this option is chosen, the following prompts appear:

INPUT TOTAL NUMBER OF TEMP BLOCKS TO BE READ:

INPUT DESIRED TEMP BLOCK NUMBERS IN ASCENDING ORDER:

INPUT SUBTITLE 2 OR BLANK (CR):
(This prompt appears for each temperature case).

15. TRANSLATE ELEMENT TEMPERATURES-------ETEMP.PAT

This option reads element temperatures from the EAL datasets TEMP XXXX, where XXXX refers to the element type. EALPAT averages the element temperatures from all element types to determine an average nodal temperature. This data will be written as packet type 10 to the neutral file. EALPAT will also average the temperature at each node on an element to determine an average element temperature. This data is written as packet 11 data to the neutral file. After this option is chosen, the following menu appears:

INPUT FILE TYPE FOR TEMPERATURE DATA:

1. **NEUTRAL FILE (GEOM.PAT)**
2. **RESULTS FILE (TEMP.PAT)**
3. **BOTH**

SELECTION: >

The user has the option of writing the results on two different PATRAN file types, the neutral or nodal results file. The neutral file is the preferred method to use when the user has multiple cases to plot and all the data is stored on one L01 file. ***The nodal results files should be used when the user has multiple cases which have been stored on different L01 files.*** EALPAT will have to be executed separately to read each L01 file.

16. USER INTERFACE

The user interface option gives the EALPAT user the option of adding a customized subroutine to EALPAT. The subroutine statement should be written in this form:

SUBROUTINE USER(MNE,NJ)

where MNE represents the maximum number of elements and NJ represents the maximum number of nodes. The values for these two variables are passed to the user subroutine from the main program. The following common statements are available from the main program and may be inserted in the user's routine if needed. The proper values for NJ and MNE can be determined by choosing the HELP option from the main and listing the program limits. These values should be substituted for NJ and MNE.

COMMON /MSIZE/ JEN(NJ,8),STRS(7*NJ),GEOM(7*NJ),A(3*NJ)
COMMON /SPROP/ F(252,6,3),ISA(MNE),D(250,2),STYPE(250),NSA
COMMON /CIDT/ IDATE,ITIME
COMMON /TITRUN/TITLE(80)
COMMON /EFLAG/IFLAG(26,2),IGROUP(26,50)

STRS and GEOM are storage arrays and may be used when reading in datasets. The other variables in common should not be overwritten by a user subroutine. A description of these variables follows:

JEN ------------------	Joint numbers for each element
A ---------------------	Joint locations
F ---------------------	Flexibility coefficients from SA data set
ISA ------------------	Property ID for each element
D ---------------------	Used to calculate strains
STOPE--------------	Property type for plate element (ISO or LAM)
NSA -----------------	Number of SA entries
IFLAG(X,1)---------	Number of elements of each type (ie. X=1 for E21, X=15 for S81)
IFLAG(X,2)---------	Number of groups for each element type
IGROUP(X,1)------	Number of elements in each group
NJ --------------------	Number of joints
MNE -----------------	Number of elements

17. X/Y PLOTTING-----------PLOT.TEM and PLOT.XYD

This option allows the users to plot AUS datasets. Data is written to XYDATA and TEMPLATE files to be used with PPLOT. It is assumed that the X-AXIS data is stored in a single blocked data set named PLTX AUS. Y-AXIS data is assumed to be located in a multiblocked dataset PLTY AUS. The number of blocks in the Y dataset should correspond to the number of X values. The number of words "N" per block corresponds to the number of sets of YDATA. The plot will contain "N" curves. Title for the curves can be input from a LABE AUS dataset or input from within PPLOT. This format was setup to plot frequency response data, but can be used to plot any data stored on an AUS dataset in the above format. When this option is chosen, the following prompts appear:

INPUT TITLE FOR X/Y PLOT:

INPUT TITLE FOR X AXIS:

INPUT TITLE FOR Y AXIS:

INPUT CURVE LABELS FROM AUS DATA SETS ? (Y or N):

CURRENT SPACING IS EVERY 10TH POINT or DELTA BETWEEN Y VALUE AND Y VALUE OF PREVIOUSLY PLOTTED POINT > 1.E-10 DO YOU WISH TO CHANGE SPACING ? (Y or N)

If the answer to the above prompt is Y, the next two prompts appear:

INPUT NEW INCREMENT (10 IS DEFAULT):

INPUT NEW Y DELTA (1.0E-10 IS DEFAULT):

The X/Y data is written to a file PLOT.XYD, and the template data is written to file PLOT.TEM.

18. HELP AND UPDATE INFORMATION

This option prints the following menu:

MENU--HELP EALPAT

1. **PROGRAM LIMITS**
2. **TRANSLATE MODEL**
3. **TRANSLATE DISPLACEMENTS**
4. **TRANSLATE ELEMENT STRESSES**
5. **TRANSLATE AVERAGE NODAL STRESS**
6. **TRANSLATE ELEMENT CENTER STRAIN**
7. **TRANSLATE MODE SHAPE**
8. **TRANSLATE NODAL PRESSURES**
9. **TRANSLATE NODAL FORCES**
10. **TRANSLATE EQNF FORCES**
11. **TRANSLATE REACTIONS**
12. **TRANSLATE NODAL TEMPERATURES**
13. **TRANSLATE STATIC TEMPERATURES**
14. **TRANSLATE TRANSIENT TEMPERATURES**
15. **TRANSLATE ELEMENT TEMPERATURES**
16. **USER INTERFACE**
17. **X/Y PLOTTING------------PLOT.TEM and PLOT.XYD**
18. **UPDATE INFORMATION**

0. **END HELP MENU**

Choosing menu items 1 thru 17 will briefly summarize the use of the main menu option listed. If 18 (UPDATE INFORMATION) is selected, a list of program revisions and revision dates will be printed.

PATEAL

The PATEAL program uses PATRAN database access routines (ref. 6) to read a PATRAN database file and output an EAL runstream. This program can be used for two purposes.

1. Convert a model generated with PATRAN into an EAL runstream.

PATEAL will convert nodes, elements, coordinate frames, material properties, section properties, loads, and boundary conditions to EAL format.

2. Convert a MSC/NASTRAN model to an EAL model.

The user can first convert a MSC/NASTRAN model into PATRAN using the NASPAT translator. Once the MSC/NASTRAN model is in a PATRAN database, PATEAL can be used to convert the database to an EAL runstream.

PATEAL Execution

PATEAL outputs 41 different EAL cards, including 17 different element types. The complete list of cards supported is presented in TABLE 2. Degenerate elements are handled properly without any special user input. PATEAL execution produces two files:

(1) **EAL.BDF** -- EAL runstream in card image format.

The EAL cards will be generated in the following order:

File header
Start
Materials
Alternate Coordinate Frames
Joint Locations
Constraints
Beam rigid link offsets
Bar and Plate Section Properties
Beam Reference Frames
Concentrated Mass
Solid Section Properties
Elements
Loads
Runstream for static solution (optional)

(2) **PATEAL.MSG** -- Error message file.

Error messages are only written to this file (not to the computer monitor). When PATEAL execution is complete, a warning message will be written to the monitor if your model translation produced errors. Errors will be generated for missing material and property assignments on element cards, missing property or material cards, or improper load inputs. If a warning message is written to the screen, the file PATEAL.MSG should be examined to determine the errors.

Beginning program execution

When the user enters the PATEAL program, the PATEAL logo will appear with the date that the program was last modified. The first prompt that appears is:

Input PATRAN data base filename:

This will be the PATRAN.DAT file (or the user's renamed database file name). There is no default for this file. PATEAL will then print the version number of the data base access library that it is using. This version number should be compatible with the version of PATRAN that was used to generate the data base.

The next prompt will be:

Input the title card for PATEAL output:

This title will be written as a comment statement to the EAL runstream. The date and time that the runstream was created will also be written as a comment statement to the EAL.BDF file.

The next message that appears will inform the user that error messages will be generated to the file PATEAL.MSG.

***** NOTE: ERROR messages will be written on PATEAL.MSG *****

PATEAL then begins reading the database. The message

Reading data base to determine model size...

will appear. When the program is executing database access or sorting subroutines that may be time consuming, informative messages will appear on the monitor followed by "...". These messages require no response from the PATEAL user and should not be followed by a carriage return.

The user is then asked whether the EAL runstream will be used on a VAX/VMS or UNIX system and to input a name where the EAL L01 file will be written. This information is needed to properly set up the EAL file header card.

Select operating system for EAL file header cards:

1. **VMS**
2. **UNIX**

Selection: >

If VMS is selected, the user is prompted for the title to be used for the EAL L01 file:

Input title for EAL L01 file:

The card 'XXXX. (where XXXX is the name input by the user) will be the first card written to the EAL.BDF file.

If UNIX is selected, the user is prompted for a subdirectory name where the EAL L01 file will be stored.

Input scr subdirectory name for EAL input file header:

The cards DD'/scr/XXXX/ and LIB 18'/scr/XXXX/utl324.118
(where XXXX is the pathname input by the user) are the first
two cards written to the EAL.BDF file.

PATEAL then begins model translation. For each item type processed, PATEAL will write the message:

PROCESSING XXXX cnt

XXXX refers to an EAL entity (for example, MATC, JLOC,etc.), and cnt is an updating counter which indicates the progress of the translation and finally the total number of items of each EAL entity translated.

The next prompt that appears is:

Generate E25 elements for duplicate nodes ? (Y or N):

This option will allow the user to have E25 elements generated for each duplicate node in the model. This is useful for modeling contact surfaces. The E25 elements are generated in order of ascending Z values, with the lower node id number always appearing first. This numbering convention should be kept in mine by the PATRAN user when generating the model if the model will be used for a non-linear analysis and the E25 element direction is important. When this option is chosen, the following prompt appears:

EPS for elements is .005, do you wish to reset ? (Y OR N)

EPS is the tolerance value used to check distance between node coordinates. If the absolute value of the distance between two coordinate values is within EPS, then coordinates are considered equal. If the user wishes to change this value and chooses Y, then the following prompt appears:

Input new value for EPS:

The user should not use this option just to "check out the model" since sorting on a large number of nodes can be time consuming. If E25 elements are not required, the user should instead use the nodal equivalence feature within PATRAN to check for and eliminate duplicate nodes. PATEAL will generate a default property card (BB matrix) for E25 elements which are generated this way. This matrix will contain all zero values. The BB matrix on the EAL.BDF file should be edited by the user and filled with the proper stiffness value.

The user may also create the BB table within PATRAN by typing the following commands during the model creation:

PROP,#,ADD,BAR/2/6,data field

where field 1 of the data field is the material number and fields 2-7 are the diagonal entries of the BB table. For example, to create the following BB table for EAL,

BB
1 0.
0. 1000.
0. 0. 10.E+6
0. 0. 0. 10.E+3
0. 0. 0. 0. 10.E+4
0. 0. 0. 0. 0. 10.E+3

the user would type:

PROP,1,ADD,BAR/2/6,1/0./1000./10.E+6/10.E+3/10.E+4/10.E+3

The next prompt that will appear is:

How has property data been stored in PATRAN?

EAL format (default)----------- 1
NASTRAN format ------------ 2

SELECTION: >

This selection refers to the way property data was entered into PATRAN. The data field of the property card is analysis code dependent. For selection 1, PATEAL assumes that the property data has been input according to TABLE 3. For selection 2, PATEAL assumes that the property data has been input according to the MSC/NASTRAN property cards, or stored in the PATRAN database using the NASPAT translator and neutral file transfer on an MSC/NASTRAN bulk data file.

PATEAL will next sort all of the elements by element type. The user has the option to also sort by property, material type, reference frame, and beam offset numbers. The following prompt will appear:

Do you wish to sort into GROUPS by NSECT or NMAT numbers?

NO SORTING (saves time)---------- 0
NSECT SORTING -------------------- 1
NMAT SORTING -------------------- 2
NSECT and NMAT SORTING----- 3
NSECT and NREF SORTING------ 4
NSECT and NOFF SORTING------ 5

SELECTION: >

Selection 0 should be used if no property numbers have been assigned to the elements or if only one property number has been assigned to each element type. Unnecessary sorting can slow translation time on a large model.

Selection 1 can be chosen when more than one property number has been assigned to an element type. Sometimes it is helpful to assign different property numbers to various portions of the model even if the data field of all the property cards may be the same. This selection can then be used to sort the element data into groups by model location as well as property type.

Selection 2 is used in the same manner as selection 2, but on material data rather that property data.

Selection 3 is useful when there are various material and property numbers for the same element type within the model.

Selections 4 and 5 only apply to bar elements and are useful when working with a beam model.

Creating the PATRAN model to be used with PATEAL

Element Definition (MESH or CFEG)

The specific PATRAN element type code ("etype") corresponding to each EAL element supported by PATEAL is listed in TABLE 3. The default element types are underlined in the table. For example, to put E44 elements on Patch 1, use the PATRAN directive:

MESH,P1,QUAD/4/6 or CFEG,P1,QUAD/4/6

Meshing a degenerate geometry region or employing topological zoom will produce some elements of a lower order than specified by the etype. For such degenerate elements, PATEAL will automatically assign the element type most compatible with etype, as defined in TABLE 4. For E44 shear elements, however, there is no corresponding triangular element. PATEAL will generate a E33 element for degenerate E44 elements. The user can either try to avoid creating TRI elements when modeling shear panels, or create them in regions where they will not impact critical results.

Element properties (PFEG or PROP)

Element property data may be entered in either the data field on the PFEG card,

PFEG, id-LPH, etype, data, pid-list, include-list

or the data field of the PROP card,

PROP, pid-list, ADD, etype, data

Refer to the PATRAN manual for a detailed description of each field.

There are two rules which must be followed when property data will be translated with PATEAL. First the PID numbers must be unique. PATEAL will renumber the property ID's to conform to EAL numbering conventions. For example, to input one SA and one BA property record, you should give them unique numbers such as 1 and 2. PATEAL will output them as "SA 1 xx" and "BA 1 xx." Second, the data field must always contain a material number in position one. Even if a particular property card may not need a material reference, PATRAN uses this field to assign material numbers to the elements. The remaining words on the data field differ depending on what type of property you are using. The following is a description of the data field for each type of EAL property record.

(1) BA - property cards for E21 elements

DATA WORD

1	Material number
2	Format type (Integer 1 to 10)
	1 BOX
	2 TEE
	3 ANG
	4 WFL
	5 CHN
	6 ZEE
	7 TUBE
	8 GIVN
	9 DSY
	10 RECT
3-20	Data for format type chosen in order specified by the EAL reference manual

Example:

Data field of BOX of material type is

3/1/.5/.25/1.0/.25

(2) BB - property cards for E22 or E25 elements

DATA WORD

1	Material number
2-7	Diagonal terms of an intrinsic stiffness matrix

For example, to create the following BB table for EAL,

BB
1 0.
0. 1000.
0. 0. 10.E+6
0. 0. 0. 10.E+3
0. 0. 0. 0. 10.E+4
0. 0. 0. 0. 0. 10.E+3

the user would type:

PROP,1,ADD,BAR/2/6,1/0./1000./10.E+6/10.E+3/10.E+4/10.E+3

(3) BC - property cards for E23 elements

DATA WORD	
1	Material number
2	Cross-sectional area

(4) BD - property cards for E24 elements

DATA WORD	
1	Material number
2-7	Data for BD card in ordered specified by EAL reference manual

(5) SA - property cards for E43, E33, E42, E32, E41, and E31 elements

DATA WORD	
1	Material number
2	Format type (Integer 1 to 6) 1 ISOTROPIC 2 MEMBRANE 3 PLATE 4 UNCOUPLED 5 COUPLED 6 LAMINATE
3-41	Data for format type specified (Refer to EAL reference manual)

Examples:

DATA field for a .5" thick isotropic E43 element of material type 2 is:

2/1/.5

DATA field for a E31 membrane element of material type 1 is:

1/2/f11/f21/f31/c11/c12/c22/c13/c23/c33

(6) SB - property cards for E44 elements

DATA WORD

1	Material number
2	Panel thickness

(7) PROP BTAB 21 -- property data for S81, S61, and S41 elements

DATA WORD

1	Material number
2	Weight or mass density
3	E - Young's modulus
4	v - Poisson's Ratio

Material Properties (PMAT)

Only PATRAN PMAT directives with the ISO option may be used to produce a EAL MATC card. The format for this card is:

PMAT, mat-id, ISO, E, G, v, RHO, Alpha

E --	Young's modulus
G --	Shear modulus,
v --	Poisson's ratio,
RHO --	Mass density
Alpha --	Thermal expansion coefficient

The user may input either E or G (or both). If only one value is input, the other will be computed with the identity $E = 2(1+v)G$.

Loads, Constraints, and Temperatures (DFEG)

Loads -- FORC option on DFEG card

Loads input with the FORC option are translated into EAL Applied Force information. For example, a 100. lb force acting in the Z direction on nodes 1-3 would be input with the following PATRAN directive:

DFEG, id-LPH, FORC, //100.,1,N1T3

This would be translated by PATEAL to read:

***XQT AUS**
SYSVEC: APPLIED FORCES
CASE 1
I = 3: J = 1: 100.
I = 3: J = 2: 100.
I = 3: J = 3: 100.

Nodal Pressures -- PRES/N option on DFEG card

Pressures input with the PRES/N option are translated into EAL Nodal Pressure information. For example, a 150. psi pressure acting normal to the element on nodes 1-3 would be input with the following PATRAN directive:

DFEG, id-LPH, PRES/N, //150.,1,N1T3

This would be translated by PATEAL to read:

***XQT AUS**
TABLE: NODA PRES
CASE 1
J = 1: 150.
J = 2: 150.
J = 3: 150.

All nodal pressure data should always be input in the third data field of the DFEG card. All other fields are ignored by PATEAL

Element Pressures -- PRES/E option on DFEG card

Pressures input with the PRES/E option are translated into EAL Element Pressure information. For example, a 150. psi pressure acting normal to the elements for E43 elements

1-3 would be input with the following PATRAN directive:

DFEG, id-LPH, PRES/E, //150.,1,EL1T3

This DFEG directive would be translated by PATEAL to read:

***XQT AUS**
ELDATA
CASE 1
PRES E43
G = 1: E = 1: 150.
G = 1: E = 2: 150.
G = 1: E = 3: 150.

All element pressure data should always be input in the third data field of the DFEG card. All other fields are ignored by PATEAL.

Nodal Temperatures -- TEMP/N option on DFEG card

Temperatures input with the TEMP/N option are translated into EAL Nodal Temperature information. For example, a 150. degree temperature acting on nodes 1-3 would be input with the following PATRAN directive:

DFEG, id-LPH, TEMP/N,150.,1,N1T3

This would be translated by PATEAL to read:

***XQT AUS**
TABLE: NODA TEMP
CASE 1
J = 1: 150.
J = 2: 150.
J = 3: 150.

All nodal temperature data should always be input in the first data field of the DFEG card. All other fields are ignored by PATEAL.

Element Temperatures -- TEMP/E option on DFEG card

Temperatures input with the TEMP/E option are translated into EAL Element Temperature information. For example, a 150. degree temperature acting on E43 elements 1-3 would be input with the following PATRAN directive:

DFEG, id-LPH, PRES/E,150.,1,EL1T3

This DFEG directive would be translated by PATEAL to read:

***XQT AUS**
ELDATA
CASE 1
TEMP E43
G = 1: E = 1: 150. 150. 150. 150. 0.
G = 1: E = 2: 150. 150. 150. 150. 0.
G = 1: E = 3: 150. 150. 150. 150. 0.

All element temperature data should always be input in the first data field of the DFEG card. All other fields are ignored by PATEAL.

Using PATEAL to transfer a MSC/NASTRAN deck into an EAL runstream

Although PATEAL was originally written to transfer data from PATRAN to EAL, it can also be used to translate a NASTRAN bulk data file to an EAL runstream. Property information and element types are two PATRAN entities that are defined by the analysis program being used. PATEAL was written to have compatible element type codes with the most compatible MSC/NASTRAN element (refer to TABLE 1). When there is no corresponding EAL element type for a MSC/NASTRAN element, the default element is generated. PATEAL also has the option of reading property data which has been stored in MSC/NASTRAN format in the PATRAN database.

To use this feature, the PATEAL user would first transfer the MSC/NASTRAN file into a PATRAN neutral file using the NASPAT translator. This neutral file could then be used to read the data into a PATRAN database. Once the NASTRAN file is in a PATRAN database, PATEAL can be used to generate an EAL model.

TABLE 1

Translation of EAL elements to MSC/NASTRAN elements

EAL Element "etype"	**PATRAN Element**	**NASTRAN Element**
E21	BAR/2/0	CBAR
E22	BAR/2/2	CBEAM
E23	BAR/2/3	CROD
E24	BAR/2/4	
E25	BAR/2/6	CELAS2
RMASS	BAR/2/7	CONM2
E31	TRI/3/4	CTRIA3
E32	TRI/3/3	
E33	TRI/3/1	CTRIA1
E41	QUAD/4/4	
E42	QUAD/4/3	
E43	QUAD/4/0	CQUAD4
E44	QUAD/4/6	CQDMEM2
S41	TET/4/1	CTETRA
S61	WEDGE/6/1	CPENTA
S81	HEX/8/0	CHEX8
F41	TET/4/2	
F61	WEDGE/6/2	
F81	HEX/8/2	

TABLE 2

EAL Items Supported By PATEAL

Alternate Coordinate Systems

ALTREF

Node Coordinates

START
JLOC

Element Definition

E21
E22
E23
E24
E25
E31
E32
E33
E41
E42
E43
E44
S41
S61
S81
F41
F61
F81

Related Element Records

NSECT
NMAT
Exx OFFS
BRL

Element Properties

BA
BB
BC
BD
SA
SB
PROP BTAB

Material Properties

MATC

Nodal Forces

APPLIED FORCES

Nodal Displacements

NONZERO
APPLIED MOTIONS

Constraints

CON
ZERO

Temperature

Nodal Temperature
Element Temperature

Pressure

Nodal Pressure
Element Pressure

TABLE 3

EAL/PATRAN Element Dictionary

EAL Element Name	PATRAN Element "etype"	EAL Property Card
E21	BAR/2/0	BA
E22	BAR/2/2	BB
E23	BAR/2/3	BC
E24	BAR/2/4	BD
E25	BAR/2/6	BB
RMASS	BAR/2/7	
E31	TRI/3/4	SA
E32	TRI/3/3	SA
E33	TRI/3/1	SA
E41	QUAD/4/4	SA
E42	QUAD/4/3	SA
E43	QUAD/4/0	SA
E44	QUAD/4/6	SB
S41	TET/4/1	PROP BTAB 21
S61	WEDGE/6/1	PROP BTAB 21
S81	HEX/8/0	PROP BTAB 21
F41	TET/4/2	PROP BTAB 22
F61	WEDGE/6/2	PROP BTAB 22
F81	HEX/8/2	PROP BTAB 22

TABLE 4

PATEAL Degenerate Elements

EAL Element	PATRAN Element "etype"	Corresponding Degenerate Element
E41	QUAD/4/4	E33
E42	QUAD/4/3	E32
E43	QUAD/4/0	E33
E44	QUAD/4/6	E33
S81	HEX/8/0	S61
F81	HEX/8/2	F61

REFERENCES

1. Whetstone, W. D.: EISI-EAL Engineering Analysis Language Reference Manual. Volume I - Program Execution. July 1983.

2. PDA Engineering: PATRAN PLUS User Manual. Volume I and II. 1987.

3. Giles, Gary L.; and Haftka, Raphael T.: SPAR Data Handling Utilities. NASA TM 78701, 1978.

4. Cunningham, Sally W.: SPAR Data Set Contents. NASA TM 83181, 1981.

5. PDA Engineering: PAT/MSC-NASTRAN Application Interface, Release 3.0, January 1991.

6. PDA Engineering: DB-ACCESS Gateway Utility, Release 2.5, October 1990.

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY *(Leave blank)*

2. REPORT DATE
February 1994

3. REPORT TYPE AND DATES COVERED
Technical Memorandum

4. TITLE AND SUBTITLE
PATRAN 2.5/EAL INTERFACE GUIDE

5. FUNDING NUMBERS
237-02-02-03

6. AUTHOR(S)
Winifred S. Feldhaus

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
NASA Langley Research Center
Hampton, VA 23681-0001

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
National Aeronautics and Space Administration
Washington, DC 20546-0001

10. SPONSORING/MONITORING AGENCY REPORT NUMBER
NASA TM-109053

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT
Unclassified-Unlimited

Subject Category 61

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*
The PATRAN/EAL interface guide describes two programs, EALPAT and PATEAL. EALPAT reads an EAL L01 file and translates the model and results into a PATRAN 2.5 neutral file, element results file, and nodal results file. An EAL model can be color coded in PATRAN, and geometry, loads, boundary conditions, section and material properties, rigid masses, springs, and beam orientations can be plotted and debugged. EAL results can be brought into PATRAN as element or nodal quantities and displayed as deformed plots, animated shapes, color coded elements, or color filled contour plots. PATEAL converts a PATRAN 2.5 data base into an EAL runstream. Geometry, including all element types, alternate coordinate systems, material properties, section properties, loads and boundary conditions are all converted. EALPAT and PATEAL can also be used together with the PATNAS translator from PDA Engineering to convert an EAL runstream to an MSC/NASTRAN bulk data file.

14. SUBJECT TERMS
PATRAN, EAL, FINITE ELEMENT MODELING, FINITE ELEMENT POST PROCESSING

15. NUMBER OF PAGES
48

16. PRICE CODE
A03

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
Unclassified	Unclassified		

NSN 7540-01-280-5500

Standard Form 298 (Rev. 2-89)
Prescribed by ANSI Std. Z39-18
298-102