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SPAR IMPROVED STRUCTURE/FLUID DYNAMIC ANALYSIS CAPABILITY

PHASE II - FINAL REPORT

CONTRACT NAS8-34975

29 June 1984

Prepared for

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
MARSHALL SPACE FLIGHT CENTER, AL 35812

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Lockheed
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FOREWORD

This final report presents the results of work performed under Contract NAS8-34975 for the National Aeronautics and Space Administration, George C. Marshall Space Flight Center, Huntsville, Alabama. This work was performed by personnel in the Product Engineering & Development Section of the Lockheed-Huntsville Research & Engineering Center and two subcontractors. The Computational Mechanics Company, Inc., Austin, Texas, served as subcontractor to Lockheed during the first phase of this effort, and Softcom Systems, Inc., Huntsville, Alabama, served as subcontractor during the second phase.

The period of performance for this study was from August 1982 through June 1984. The MSFC Contracting Officer's Representative for this study was Larry A. Kiefling, ED22.
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1. INTRODUCTION

SPAR (Structural Performance Analysis and Redesign) is a widely used general purpose structural analysis finite element code. SPAR has been developed over the past several years under contract to NASA-Marshal Space Flight Center and NASA-Langley Research Center. Development is currently being done by Lockheed.

This contract consisted of two phases. The objective of the first phase was to adapt or develop an efficient and general method of analyzing a coupled dynamic system of flowing fluid and elastic structure. The results of this phase are documented in an interim report (Ref. 1), issued in August 1983. J. T. Oden of The Computational Mechanics Company, Inc., Austin, Texas, served as subcontractor to Lockheed during this phase.

The objective of the second phase was to improve the operation of SPAR by improving efficiency, user features, and documentation. M. L. Pearson of Softcom Systems, Inc., Huntsville, Alabama, served as subcontractor to Lockheed during this phase. This report contains a summary of the work performed during the second phase of the contract.

Improvements were made in the SPAR graphics processors, particularly in the area of user interaction. All error codes in the program were documented, including recommended corrective action where appropriate. A SPAR processor/subroutine cross reference was included also.
2. SPAR UPDATES

2.1 GENERAL

Several improvements were made in the SPAR graphics processors during this study. The conversion of PLTB to the MSFC Univac Tektronix Graphics system was completed. This provides a means for updating and improving the Tektronix version of this processor, PLTB/TEK. Also, additional stress display capability was added to both versions.

The improved versions of PLTB and PLTB/TEK reside in the MSFC Tape Library on reel #24402. The absolute programs are on file 1, the PLTB/TEK symbolics and relocatables are on file 6, and the PLTB symbolics and relocatables are on file 7.

Both PLTB and PLTB/TEK may be used with SPAR 15C.

2.2 PLTB/TEK

Several improvements were made in the user interface to PLTB/TEK. The principal features of the new version are:

- Completes frame automatically without requiring user to input the next command.

- Provides an automatic hardcopy and frame advance option. (OPTION 30)

- Sounds bell and waits for user to enter a "RETURN" before clearing screen.
o Utilizes entire screen area for single view plot specifications with the longer dimension in the horizontal direction.

o Provides a choice of four character sizes for "large" characters on 4014 models. (Frame labeling is done with the selected "large" character size.)

o Provides RESET for operation on 4010 models.

Resets

RESET NDEV=4010 (for 4010 models)
RESET NDEV=4014 (for 4014 models without enhanced graphics)

Note: Defaults to 4014 models with enhanced graphics.

RESET CHRS=n (defaults to ^c)

Note: This reset applies to 4014 models with enhanced graphics only.

CHARACTER SIZE 1 Optional "large" character size
CHARACTER SIZE 2 Default "large" character size (Options 10, 12, etc.)
CHARACTER SIZE 3 Optional "large" character size
CHARACTER SIZE 4 "Small" character size (Options 11, 13, 15, etc.) (May also be selected for "large" character size, CHRS=4)
2.3 LAMINATE STRESS DISPLAY

Stress display capability for E33 and E43 elements with laminate section properties was added to both PLTB and PLTB/TEK.

The format of the control statement to cause stress or internal load data to be displayed is as follows:

\[
\text{LAMINATE} = SX/\text{div}, \text{node, layer, TXY, ...}
\]

Notes

- "/\text{div}" may be omitted.
- "node" and "layer" must be present for stress displays (SX, SY, TXY). (No default exists for "layer".)
- "node" and "layer" may be omitted for internal load (stress resultant) displays. ("layer" is meaningless for internal load displays.)
- Principal stress quantities are not available for laminate sections.
3. ERROR CODE DOCUMENTATION

3.1 GENERAL

This section contains a tabulation of the error messages produced by the SPAR processors. The messages are grouped by processor and arranged in alphabetical order within each processor group. The symbolic name of the SPAR routine that produces the message is indicated along with the name of the file in which the routine resides.

Except for messages which are self explanatory, a brief explanation of the error is given, along with recommended corrective action where appropriate.

Messages which are produced by two or more routines within a single processor are listed only once under that processor heading, but the filename and symbolic name are given for each routine within that processor which may generate the message.

Identical messages which may be produced by two or more processors are listed under each processor heading. Messages which are generated by various SPAR utility routines, and therefore, may arise from any or all processors, are listed under the heading "All Routines" at the beginning of the section.

Many of the error codes are documented in the SPAR Reference Manual (Ref. 2), and are repeated here in order to provide a complete error code document.
3.2 ALL PROCESSORS

Error Message

ERROR IN INPUT FORMAT. REC/WORD/CHAR= x x x
KK= x x x x x x
FATAL ERROR. NERR, N=DECO n

FATAL ERROR. NERR, N=XXXX x
This message is often preceded by an explanatory message. Descriptions of specific messages of this form are given in the individual processor sections.

FATAL ERROR. NERR, N=SGB n
An attempt was made to reference a non-existent SPAR library n.

FATAL ERROR. NERR, N=OWRT n
An attempt was made to overwrite a TOC entry for a data set not present in library n.

FATAL ERROR. NERR, N=RIND n
The maximum number of data sets allowed for library n has been reached. The normal limit is 2048 data sets per library.

INOPERABLE DATA SET.
This message is followed by a TOC line printout of the faulty data set.

INPUT DATA ERROR. RECORD n
This message indicates an error in input record n. If multiple records are placed on a card image via use of colons (:), the "n" refers to the input "record" number and not the card image number. An echo of the data record containing the error is printed out.
**Error Message**

LIB READ ERROR. NU,L,KORE,IERR= x x x x 
NAME= XXXX XXXX x x 

An attempt to access a data set was unsuccessful. The symbols are defined as follows:

NU = SPAR library 
L = Data set block length (if the data set exists) 
KORE = Core space available for loading the data set. 
IERR = Error code 
-1 - data set is incomplete (or absent) 
1 - minor error in data set 
2 - core space is insufficient to load data set. 
NAME = Data set name 

This message may be followed by

FATAL ERROR. NERR, N=RERR x 

**RESET ERROR. IMAGE FOLLOWS.** 
Card image echo 
FATAL ERROR. NERR, N=RESE n 

An error is present on the above RESET command.
Error Message

** RIO ERR. NU,IWR,IOP,KSHFT,L,ISTAT= x x x x x x R2.RIO/9
INDEX= x x x x x x x

An error occurred during an I/O transmission. The parameters have the following meanings:

NU = SPAR library.
IWR = 1, if writing; 2, if reading.
IOP = Addressing mode indicator.
KSHFT = Addressing parameter.
L = Number of words in the requested transmission.
ISTAT = I/O Status Code
INDEX = Parameters used in diagnosis.

TAPE READ ERROR. R2.TIO/6
NTAPE,L,IO,ISTAT,NWT= x x x x x
FATAL ERROR. FERR, N=TAPE n

An error occurred during a tape I/O transmission. For description of I/O status codes (ISTAT), see: SPERRY UNIVAC SERIES 1100 Executive System Volume 2 EXEC Manual, page C-19.
3.3 TAB

Error Message

BEND STIFFNESS MATRIX SINGULAR, ENTRY x

R3.F1T13/11
(ASA)

*****COORDINATE INPUT ERROR: I, J, JLOCAL, JOINT = x x x x

R3.F1T051/8
(XBLOCK)

CORE INADEQUATE TO FORM QJ(3,3,JT). AVAIL, REQ= x x

R3.AQJJT/7

ERROR IN SPECIFICATION OF JOINT ELIMINATION ORDER

R3.F1T17/11
(SEQGEN)

ERROR, K=1 NOT ALLOWED

The global frame is always 1; therefore, alternate reference frames must start with 2.

***ERROR. JOINT REFERENCE FRAME ASSIGNMENT
PRECLUDES SYMMETRY OR ANTI-SYMMETRY CONSTRAINT.

R3.F1T15B/10
(SASCON)

***ERRORS IN INPUT PREVENT CALCULATION OF QJ(3,3,JT) R3.AQJJT/7

One of the following data sets is marked in error as a result of input data errors:

ALTR BTAB 2 4
JLOC BTAB 2 5
JREF BTAB 2 6

X ERRORS IN ELIM ORDER SPECIFICATION

R3.F1T17/11
(SEQGEN)

***FATAL ERROR IN ABOVE DATA

R3.F1T08/7
(ARL2)

FATAL ERROR. NAME,N=xxxx x

R3.F1T09/15
(ABA)

Card out of sequence.
Trying to read section property continuation card.

FATAL ERROR. NERR, N=INCD n

R3.INCARD/7
Error Message

FATAL ERROR. NERR, N=JT n
Invalid number of joints, n, on 'START' card.

FATAL ERROR. NERR, N=KORE n
Core space too small by n words.

FATAL ERROR. NERR, N=NREF n

FATAL ERROR. NERR, N=SX x

FATAL ERROR. NERR, N=XJDF x
Illegal joint motion 'component, x, specified on 'START' card.

*** FATAL INPUT ERROR. NEGATIVE INDEX OR INSUFFICIENT CORE. NAME= xxxx

ILLEGAL DATA. JOINT, NJ, JUMP= x x x
Illegal rigid mass input data.

***ILLEGAL INPUT DATA BELOW

***ILLEGAL JOINT, x

ILLEGAL MATERIAL INDEX, x. K= x
Illegal material index specified for K-th section.

INPUT DATA ERROR, RECORD x
card image echo
    Error in constraint definition data.
Error Message

**INPUT ERROR, JO=x**

**Input data card is out of order.**

**INPUT FORMAT ERROR (FATAL)**

Card missing or out of sequence. Trying to read intrinsic stiffness matrix continuation card.

**JOINT x NOT SPECIFIED IN INPUT LIST**

**MEMB STIFFNESS MATRIX SINGULAR, ENTRY x**

**SA ENTRY x, ERROR CODE xx**

**Code**

W1 - Structural weight data given for section (or W3) not previously defined.

W2 - Structural weight data not in real form.

The following apply only to record 1:

W4 - k not in integer form.

W5 - Trailing data not in real form.

The following apply only to records 2 and 3:

D1 - Empty record.

D2 - Too many words in record.

D3 - Non-real data in record.

The following apply only to LAMINATE section layer input:

C1 - Record contains other than 3, 9, or 15 words.

C2 - No layers defined, or singular stiffness matrix.

C3 - Number of layers exceeds maxnl.
Error Message

*** SI SYNTAX ERROR.

UNKNOWN FORMAT, xxxx
Invalid shell section property format type in SA.

UNRECOGNIZABLE DATA SKIPPED.
INPUT DATA ERROR, RECORD x
card image echo

WARNING. II CHANGED TO 1 BY PROGRAM. II WAS x.

*** WARNING. ERRORS IN SOURCE DATA
A data set marked in error was encountered.

*** WARNING. x SETS OF DATA MISSING, ARRAY xxxx
3.4 ELD

Error Message

ERROR, ELEMENT TYPE xxxxx
FATAL ERROR. NERR, N=TTE n
n=2 - LRTED block length is too small.
=3 - Core space is insufficient.
=4 - Core space is insufficient to read data set.

*ERROR: NIJ,NGRP,INDEX, NSECT= xxxxx x x x
Invalid section property reference, NSECT.

FATAL ERROR. NERR; N=ELD2 i
Invalid MAJOR/NODES for EXPE, TEXP elements.

FATAL ERROR type n m
Invalid data in element input data for group n element m. Usually an invalid joint number, material reference, etc.

INCORRECT NI IN DATA SET xxxxx xxxxx
FATAL ERROR. NERR, N=ELD n
n=0 - Unrecognizable element type.
=2 - Error in experimental element type data.

MAX. OF x GROUPS EXCEEDED.

*** WARNING. ILLEGAL GROUP NO. CHANGED FROM x TO y
3.5 E

Error Message Spar Routine

**CORE INADEQUATE. L2J= 1 R5.EXDEM/15
Reset core to a larger value.

CORE SPACE INSUFFICIENT TO GENERATE E-FILE. KORE= n R5.F3A/14
M1-B= x x x x x x x x x x
FATAL ERROR. NERR, N=KORE n

Reset core to a larger value.

CORE SPACE INSUFFICIENT TO GENERATE E-FILE. R5.F3B/14
TYPE= xxxxx
FATAL ERROR. NERR, N=KORE n

Reset core to a larger value.

CURVED BEAM INPUT ERROR. RADIUS, CHORD= x x R5.F32A/15
GROUP, INDEX, J1, J2= x x x x

EFILE CANNOT BE FORMED. ERRORS IN ELEMENT TYPE xxxxx R5.F3B/14

*** ELEMENT GEOMETRY CHECK, ERROR CODE= m, IERR= n R5.GELDC/12
TYPE, GROUP, INDEX= xxxxx x

ELEMENT GEOMETRY ERROR SUMMARY R5.GESMRY/12

ERROR ERROR TEST ERROR TEST DESCRIPTION
CODE FLAG VALUE COUNT
1 x x n MINIMUM LENGTH OF BOUNDARY
2 x x n MINIMUM ANGLE BETWEEN BOUNDARIES
3 x x n WARPED 4-NODE SURFACE
4 x x n EXCESSIVELY WARPED 4-NODE SURFACE
5 x x n UNACCEPTABLE PROPORTIONS
6 x x n IRREGULAR 6-NODE SOLID
7 x x n SURFACE R-MATRIX NOT ORTHOGONAL
8 x x n MINIMUM LOCAL Z-COORDINATES, SOLIDS

ERRORS IN R-MATRIX, ELEMENT CONNECTING NODES x x x x R5.F3DX/12
R= "matrix printout"
R*R-TRANSPOSE= "matrix printout"
ABOVE ERROR IN ELEMENT CONNECTING JOINTS x x x x
Error Message

ERRORS IN SURFACE R-MATRIX
R= "matrix printout"
R*R-TRANSPOSE= "matrix printout"

EXCESSIVE ERROR IN R-MATRIX CALCULATIONS,
EXECUTION WILL BE TERMINATED.
CHECK ORIENTATION SPECIFICATIONS.

FATAL ERROR. NERR, N=E n
n=1 - Error in element data from TAB.
  =2 - Error in beam orientation (MREF) data from TAB.
  =3 - Error in beam rigid link (BRL) data from TAB.

FATAL ERROR. NERR, N=IERR ierr

FATAL ERRORS PREVENT FURTHER EXECUTION
FATAL ERROR. NERR, N=TYPE ltype

ILLEGAL SECTION TYPE
xxxx GROUP,INDEX,NSECT,TYPE= x x x x
ABOVE ERROR IN ELEMENT CONNECTING JOINTS x x x x

ILLEGAL ZERO-LENGTH ELEMENT. TYPE CODE, NGRP,
INDEX, J1, J2, LENGTH= x x x x x x
LENGTH OF SIDE x x= x
FOR ACCEPTABLE PROPORTIONS, MAX. LENGTH= x
LENGTH OF SIDE x x= x
MINIMUM LENGTH= x
POINT 2-NODE ELEMENT HAS FINITE LENGTH.
Error Message

SIN OF THE ANGLE AT JOINT   n=   x   R5.GEFACE/12
SIN OF MINIMUM ANGLE=   x

TRIANGULAR FACES ARE NOT PARALLEL  R5.GE3D/14

***** WARNING- R MATRIX CALCULATIONS INACCURATE.  R5.F32A3/1
CHECK ORIENTATION SPECIFICATIONS.  (RPOINT)
   R ROWS=   x   x   x   x   x   x   x   x   x   x
   RR= ROWS=   x   x   x   x   x   x   x   x   x   x

ABOVE ERROR REFERS TO ELT CONNECTING JOINTS  n   m

************* WARNING- SIGNIFICANT NUMERICAL  R5.F32A4/1
INACCURACIES IN R-MATRIX COMPUTATION.  (DIRCOS)
SUBSTANTIAL SOLUTION ERRORS PROBABLE.
CHECK MEMBER AXIS ORIENTATION DATA IN INPUT.

ABOVE ERROR REFERS TO ELT CONNECTING JOINTS  n   m

WARPED 4-NODE SURFACE, X34=   x   R5.GEFACE/12
TEST VALUE=   x

Z COORDINATES OF NODES n-m MUST BE GREATER THAN   x   R5.GE3D/14
3.6 EKS

Error Message

*** ADDITIONAL CORE REQUIRED FOR ELEMENT K, NEED = n RJ.K2D/11A

ARRAY TOO LARGE FOR FLUSH BUFFER
RTN, ID, NWDS, LRFLSH= xxxxx xxxxx n m

*** CORE INSUFFICIENT TO GENERATE ELT K AND S.
TYPE, LR3, KREM= xxxxx len k

The amount of additional core needed is len-k.

ERROR n, xxxxx x x

*** INSUFFICIENT CORE FOR COMPUTING H
n PROVIDED m REQUIRED

** K3D ERROR, INV n

Singular element matrix.

NON-POSITIVE DEFINITE K, CURVED BEAM. NERR, ROW= n

*** WARNING, H MATRIX IS SINGULAR, ISING = n
3.7 MN

Error Message Spar Routine

ARRAY TOO LARGE FOR FLUSH BUFFER RJ.FILER/12
RTN, ID, NWDS, LRFLSH = xxxx xxxx n m

ERROR: xxxx n m, MATERIAL= x RS.NF3D/15
n=1 - Problem with material index. RS.PRNLSS/15
=2 - Too many layers. RS.TK3D/15

This message is followed by
FATAL ERROR. NERR, N=name n
where name = NF3D, PRNL, or TK3D.

FATAL ERROR. NERR, N=CONS n RS.NLMCLD/15
n=1 - NONL CONS n m data set is in error.
=3 - NONL CONS n m data set is missing.

FATAL ERROR. NERR, N=INSS 1 RS.INNLSS/15
Insufficient core to execute MN.

FATAL ERROR. NERR, N=MN n RS.MPMN/15
n=1 - Error in NLSS data set.
=2 - Insufficient core to execute MN.
=3 - Error associated with NF FORC n m data set.
=1000 - Unrecognized input data card.

FATAL ERROR. NERR, N=TRMC R5.TRMC0/15
A tabulation of error codes follows.

Code

1 - STRE CURV n m data set is in error.
2 - AIN dimension is not divisible by 2.
3 - Insufficient core.
4 - Poisson's ratio is greater than .5.
5 - Adjacent strains are equal.
6 - Illegal code number.
7 - Initial E is zero.
3.8 TOPO

Error Message

CORE INSUFFICIENT TO PROCESS FILE 7

Reset core to a larger value.

CORE SPACE INADEQUATE FOR MFILE CONSTRUCTION

Reset core to a larger value.

CORE SPACE INSUFFICIENT, STAGE n (JOINT m) J= x

Reset core to a larger value.

FINAL ACCUMULATOR SIZE INSUFFICIENT, N= n

INCREASE ESTIMATED NO. OF ELEMENTS (LAPROX) AND RE-RUN. (ELSORT)

NELS= n
J, LRNG(J), JADR(J) = x x x

ILLEGAL JOINT NUMBER, x x x x x x x x

JOINT ELIM SEQ ERROR CODE=

Error in joint elimination sequence generated in TAB.
Unable to execute TOPO.

KMAP ACCUMULATOR SIZE EXCEEDED, JOINT n

Reset LRKMAP to a larger value (default is 896).

KSUB EXCEEDS LIMIT OF n STAGE= x, J= x, K= x

Reset MAXSUB to a larger value (default is 1000).
Error Message

M-FILE ACCUMULATOR SIZE EXCEEDED, JOINT n

Reset LRAMAP to a larger value (default is 1792).

SORTING BLOCK LENGTH INSUFFICIENT, N= n

INCREASE ESTIMATED NO. OF ELEMENTS (LAPOX) AND RE-RUN. (ELSORT)
3.9 K

Error Message

K ALLOCATION. CORE, N1-7= x x x x x x m
FATAL ERROR. NERR, N=KORE n

Insufficient core. Available = n, required = m.

*** K FILE FLOCK SIZE INSUFFICIENT.
STAGE, JOINT, CONRNG, LRECA= x x x x
FATAL ERROR. NERR, N=INV 0

Reset LREC to a larger value (default is 2240).
3.10 M

Error Message

*** K FILE BLOCK SIZE INSUFFICIENT.
STAGE, JOINT, CONRNG, LRECA= x x x x

Reset LREC to a larger value (default is 2240).

M ALLOCATION. CORE, N1-7= x x x x x x m
FATAL ERROR. NERR, N=KORE n

Insufficient core. Available = n, required = m.

..WARNING.. WRONG ELEMENT DIMENSION INPUT INTO CMQP R6.M64/5
MASS MATRIX CAN NOT BE OBTAINED.

..WARNING.. WRONG ELEMENT DIMENSION INPUT INTO CMTP R6.M63/5
MASS MATRIX CAN NOT BE OBTAINED.
Error Message

*** K FILE BLOCK SIZE INSUFFICIENT.
STAGE, JOINT, CONRNG, LRECA= x x x x
Reset LREC to a larger value (default is 2240).

KG ALLOCATION. CORE, N1-7= x x x x x x m
FATAL ERROR. NERR, N=KORE n
Insufficient core. Available = n, required = m.

..WARNING.. WRONG ELEMENT DIMENSION INPUT INTO GQP, STIFFNESS MATRIX CAN NOT BE OBTAINED.

..WARNING.. WRONG ELEMENT DIMENSION INPUT INTO GTP, STIFFNESS MATRIX CAN NOT BE OBTAINED.
3.12 INV

Error Message

*** A-FILE BLOCK SIZE INSUFFICIENT.
STAGE, JOINT, CONRNG, LRECA= x x x
Reset LRA to a larger value (default is 3584).

*** CORE INSUFFICIENT TO EXECUTE REDUCTION SEQUENCE. R6.AFLD/9
AVAIL/REQ= x x SIZE INDEX= x
FATAL ERROR. NERR, N=KORE n

*** MFILE/KMAP INCONSISTENCY
The AMAP data set being used by INV is inconsistent with the assembled system matrix to be factored. Check RESET controls to confirm KLIP, ILIB, and K values. Re-execute TOPO if the required AMAP data set is not available.

NEGATIVE DIAG TERM. JOINT/COMPONENT=x x

*** WARNING. SYSTEM K SINGULAR. JOINT/COMPONENT=x x
3.13 AUS

Error Message

ADDITIONAL CORE REQUIRED= n
FATAL ERROR. NERR, N=KREQ n

Core is too small by n words.

ARG ERROR n, WORD i=xxxxxxxx
INPUT DATA ERROR, RECORD n
card image echo
FATAL ERROR. NERR, N-ARG 0

CORE AVAILABLE, REQUIRED= x x
Insufficient core.
Reset to larger value.

CORE AVAIL/REQ= x x
Insufficient core.
Reset to larger value.

*DATA OUT OF ORDER, N= n
FATAL ERROR. NERR, N=NORD n

ERROR. NO BOUNDARY NODES.
FATAL ERROR. NERR, N=NOBN 0

ERROR. OUT-OF-RANGE TRANSMISSION PARAMETERS.

*ERROR. EXISTING ARRAY MUST NOT BE EXTENDED.

*ERROR. NO SOURCE NAMED.

*ERROR. NON-EXISTENT ELEMENT. n m

n - group
m - index

3-21
Error Message

FATAL ERROR. NERR, N=CORE  n
Core is too small by n words.

FATAL ERROR. NERR, N=KORE  n
Insufficient core.
In TITL, n indicates required data space in words.
In UNION, n indicates number of words by which core is too small.

FATAL ERROR. NERR, N=MAXN  n
Too many names, n.

*ILLEGAL OPERATION. xxxx xxxx
FATAL ERROR. NERR, N=ELDA  2

ILLEGAL OPERATION, NX, NY= x x
FATAL ERROR. NERR, N=ILLE  0

ILLEGAL Q INPUT, JOINTS= x x

ILLEGAL VECTOR INPUT

INCOMPATIBILITY. LX,LY, TYPES= x x x x

**INCOMPATIBILITY.IN SVV. N/N. L/L= x x x x

INCOMPATIBLE MATRICES
INPUT DATA ERROR, RECORD  n
card image echo
FATAL ERROR. NERR, N=ERR  0
Error Message

**INCOMPATIBLE MATRICES. J/NSA/NSB= x x x  
FATAL ERROR. NERR, N=INCO j

INPUT DATA ERROR, RECORD n 
card image echo 
FATAL ERROR. NERR, N=ILEG 0

INPUT DATA ERROR, RECORD n 
card image echo 
FATAL ERROR. NERR, N=ILLE 0

INPUT DATA ERROR, RECORD n 
card image echo 
FATAL ERROR. NERR, N=VLD 0

*LIMIT OF x LOOP LIMIT RECORDS EXCEEDED 
INPUT DATA ERROR, RECORD n 
card image echo 
FATAL ERROR. NERR, N=LOOP i

*NON-EXISTENT DATA BLOCK. n 
FATAL ERROR. NERR, N=NEXD n

*NON-EXISTENT VECTOR nv 
INPUT DATA ERROR, RECORD n 
card image echo 
FATAL ERROR. NERR, N=ERR 0

RMAT CORE AVAIL/REQ= m n 
Insufficient core 
Reset to larger value.
** RMAT FATAL ERROR  ierr 

This message may arise from RPROD, RTRAN, or RINV.
A tabulation of error codes follows.

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>X not rectangular</td>
</tr>
<tr>
<td>2</td>
<td>X not real</td>
</tr>
<tr>
<td>3</td>
<td>Y not real</td>
</tr>
<tr>
<td>4</td>
<td>Y not rectangular</td>
</tr>
<tr>
<td>5</td>
<td>X,Y not conformable for multiplication (RPROD)</td>
</tr>
<tr>
<td>6</td>
<td>X not square (RINV)</td>
</tr>
</tbody>
</table>

This message is followed by:

** INPUT DATA ERROR, RECORD  n 
card image echo 

** SINGULARITY, ISING=  i 
INPUT DATA ERROR, RECORD  n 
card image echo 

** TERM  n, BLOCK LENGTH INCOMPATIBILITY. 11 12 
FATAL ERROR. NERR, N=INCO 0 

** TRAN ERROR. NO OF SOURCE, DEST BLOCKS=  x  x 
FATAL ERROR. NERR, N=ELDA 1 

** UNKNOWN LOAD TYPE xxxx 
FATAL ERROR. NERR, N=ELDA 1 

** XTY. CORE AVAIL/REQ=  m  n 
FATAL ERROR. NERR, N=CORE  n 

- Insufficient core
- Reset to larger value.
3.14 DCU

Error Message

ERROR, EMPTY LIB. n
NON-EXISTENT ELEMENT REFERENCED. CARD m
FATAL ERROR. NERR, N=IDCO m

Library n is empty.

**ERROR IN FOLLOWING STATEMENT.**
CHANGE ( n) XXXX XXXX x x TO XXXX XXXX x x

ILLEGAL COMMAND. XXXX

This message may be followed by:

FATAL ERROR. NERR, N=TLLE x

INSUFFICIENT CORE. LB,KORE= n m
FATAL ERROR. NERR, N=KORE n

Core space is insufficient.
Core available = m. Core required = n.
Reset core to 15000 + n.

NON-EXISTENT ELEMENT REFERENCED. CARD m
FATAL ERROR. NERR, N=IDCO m

Element referenced on input record m not found.
3.15 VPRT

Error Message

FATAL ERROR. NERR, N=CORE n

Insufficient core.
Reset core such that data space contains n words.
3.16 EQNF

**Error Message**

**Spar Routine**

FATAL ERROR. NERR, N=EFIL 0

XXXX EFIL x x data set missing or in error.

FATAL ERROR. NERR, N=IERR 0

NODA TEMP x x data set missing or in error,
or NODA PRES x x data set missing or in error.

FATAL ERROR. NERR, N=KORE n

Insufficient core.
Reset core such that data space contains n words.
3.17 SSOL

**Error Message**

*ADDITIONAL CORE REQ= n
FATAL ERROR. NERR, N=ERR  n

Increase core by n words.

FATAL ERROR. NERR, N=CORE  n

Insufficient core. Increase core by n words.

*FATAL ERRORS IN LOAD INPUT.
FATAL ERROR. NERR, N=ERR  0

*INPUT LOAD BLOCK SIZE ERROR.  x  x
FATAL ERROR. NERR, N=ERR  0

*NO LOAD INPUT.
FATAL ERROR. NERR, N=ERR  0
3.18 GSF

Error Message

FATAL ERROR. NERR, N=EMAX n
Too many element group control cards given.

KORE,JDJT,LSBLK,LE3= x x x x
FATAL ERROR. NERR, N=KORE n
Insufficient core. Reset to a larger value.

NON-EXISTENT GROUPS. x x

Spar Routine
Error Message

FATAL ERROR. NERR, N=SA nsect

A TAE/ELD inconsistency is indicated.
No laminate shell section property (SA) table entry
was found for section nsect, indexed by an E33/E43
element for which stresses were desired.
3.20 EIG

Error Message Spar Routine

** CORE INADEQUATE FOR RR SOL. AVAIL/REQ/N= k m n R9.EIGLD/9
FATAL ERROR. NERR, N=KREQ m

k is the core available.
m is the core required.
n is the number of modes.

CORE REQ FOR DSOL= m, AVAILABLE= n R9.EIGLD/9
FATAL ERROR. NERR, N=CORE m

Insufficient core. m words of data space are required.

FATAL ERROR. NERR, N=LVEC 1 R9.EIGLD/9

Block length, 1, of data set used for initial approximation (default VIBR MODE 1 1) is inconsistent with the number of joints in the model.

FATAL ERROR. NERR, N=MXRT n R9.EIGLD/9

Too many modes, n.
3.21 DR

**Error Message**

ARG ERROR x , WORD i=xxxxxx
INPUT DATA ERROR, RECORD n
card image echo
FATAL ERROR. NERR, N=ARG 0

An error is present in input record n.

**BTA1 ERROR. DATA REQ OUT-OF-RANGE, ARRAY x**

CORE AVAILABLE, REQUIRED= m n
FATAL ERROR. NERR, N=CORE n

Reset core such that data space contains n words.

**CORE AVAIL, REQ= m n**

Insufficient core.
Reset core such that data space contains n words.

CORE INADEQUATE. CORE, NTRANS= m n
FATAL ERROR. NERR, N=ERR 0

Data space required is n words.

*ERROR. INCOMPATIBLE XTF,A,DTEX,TIME.*

*ERROR. INCOMPATIBLE XTMR,QR2,DTEX,TIME.*

FATAL ERROR. NERR, N=INIT 0

IQX XXXX x x
or IQX1 XXXX x x data set is in error.

FATAL ERROR. NERR, N=IQR 0

IQR XXXX x x data set is in error.
Error Message

INPUT DATA ERROR, RECORD x
card image echo
FATAL ERROR. NERR, N=ERR 0

An error was encountered on input record x.

**INPUT DATA INCONSISTENT.**

INSUFFICIENT CORE. AVAIL, REQ= m n
FATAL ERROR. NERR, N=CORE n

Reset core such that data space contains n words.

Y=XXX MUST FOLLOW T=XXX
FATAL ERROR. NERR, N=ERR 0
3.22 PLTA

Error Message

***WARNING*** FIRST SPEC COMMAND HAS NOT BEEN READ. RP.GPF02/12
THE FOLLOWING CARDS WILL BE IGNORED. (GPFCON)

***WARNING*** INVALID MARGIN.
DEFAULT VALUE OF 0.12 WILL BE USED. (GPFCON)

***WARNING*** THE ABOVE SPECIFICATION IS MARKED
IN ERROR. NERR1= x  NERR2= x (GPFCON)

***WARNING*** THE FOLLOWING CARD FOLLOWS A LINES
OR ELEMENTS COMMAND. CARD WILL BE IGNORED.

***WARNING*** TOO MANY ENTRIES SPECIFIED FOR x
ARRAY. PROCESSING TERMINATED AT n ENTRIES.

***WARNING*** TOO MANY TEXT CARDS.
THE FOLLOWING CARDS WILL BE IGNORED. (GPFCON)

***WARNING*** REPEATED COMMAND. THE FOLLOWING
CARD WILL REPLACE PREVIOUS DATA. (GPFCON)

*** ERROR *** DATA ASSOCIATED WITH ABOVE COMMAND
IS IN ERROR. PROCESSING OF COMMAND WILL BE TERMINATED.

*** ERROR *** INSUFFICIENT CORE
KORE= xxx
KREQ= xxx

*** ERROR *** INVALID SPEC ID.
THE FOLLOWING CARDS WILL BE IGNORED. (GPFCON)

*** ERROR *** LINES COMMAND OUT OF ORDER.
THE FOLLOWING CARD WILL BE IGNORED. (GPFCON)
Error Message

*** ERROR *** SPEC ID EXCEEDS MAXIMUM NUMBER OF SPECIFICATIONS. MXSPEC = n
THE FOLLOWING CARDS WILL BE IGNORED.

*** ERROR *** XXXX VALUE OF n IS OUT OF RANGE. MAX = m
PROCESSING OF COMMAND WILL BE TERMINATED.

*** ERROR SUMMARY *** THE FOLLOWING SPECIFICATIONS ARE MARKED IN ERROR.
3.23 PLTB

Error Message

DNORM NOT GIVEN

FATAL ERROR. NERR, N=CORE n

Insufficient core. Increase data space by n words.

FATAL ERROR. NERR, N=SSNC 0

Error encountered while retrieving stresses.

INCOMPLETE STRESS FILE INPUT.

itype igroup index kx1 kx2

Re-execute GSF and compute stresses for all elements.
Only complete element stress data sets may be plotted.

INPUT DATA ERROR, RECORD n

card image echo

INSUFFICIENT CORE STORAGE

CORE AVAILABLE = kore
CORE REQUIRED = kreq
FATAL ERROR. NERR, N=CORE kreq

INSUFFICIENT CORE STORAGE FOR DEFORMED STRUC PLOTS.

CORE AVAILABLE = kore
CORE REQUIRED = kreq

MODE/EVAL DATA INCONSISTENT n m

FATAL ERROR. NERR, N=INCO n

N= n. ILLEGAL L1,L2= 11 12
FATAL ERROR. N=ILLE n

Error in CASES (or VECTORS) statement. Either case1
or case2 is out of range, or case2 is less than case1.

NO STRESS/LOAD QUANTITIES DEFINED.
Error Message

TOD M ANY STRESS/LOAD QUANTITIES n

A maximum of 10 stress quantities may be plotted.

***WARNING*** SPEC n IS NOT PRESENT ON GPS FILE

***WARNING*** SPEC n WILL NOT BE PLOTTED.

ERROR TYPE = x

Spar Routine

RP.STRLST/10

RP.L602/12

RP.SD02/12

RP.L602/12

RP.SD02/12
PXY ERROR NO. icode

Error Message

A tabulation of error codes follows.

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>301</td>
<td>BOUNDARY, parameters not floating point numbers.</td>
</tr>
<tr>
<td>302</td>
<td>h2 .LT. h1</td>
</tr>
<tr>
<td>303</td>
<td>v2 .LT. v1</td>
</tr>
<tr>
<td>621</td>
<td>XAXIS or YAXIS, ndigits not integer.</td>
</tr>
<tr>
<td>622</td>
<td>dxic floating point.</td>
</tr>
<tr>
<td>631</td>
<td>ndigits integer.</td>
</tr>
<tr>
<td>632</td>
<td>mintics</td>
</tr>
<tr>
<td>633</td>
<td>maxtics</td>
</tr>
<tr>
<td>801</td>
<td>XLIMITS or YLIMITS, syntax error.</td>
</tr>
<tr>
<td>811</td>
<td>xleft or ybottom not floating point.</td>
</tr>
<tr>
<td>812</td>
<td>xbottom or ytop</td>
</tr>
<tr>
<td>1101</td>
<td>XYScale, illegal syntax or rxy value.</td>
</tr>
<tr>
<td>1201</td>
<td>TEXT, source data set unavailable.</td>
</tr>
<tr>
<td>1301</td>
<td>TPOSITION, plateral not integer.</td>
</tr>
<tr>
<td>1302</td>
<td>pvertical</td>
</tr>
<tr>
<td>1401</td>
<td>X or Y, source data set not available.</td>
</tr>
<tr>
<td>1601</td>
<td>FONT, unknown font identifier.</td>
</tr>
<tr>
<td>3004</td>
<td>INITIALIZE, FONT, illegal font code.</td>
</tr>
<tr>
<td>3101</td>
<td>PLOT, command syntax error.</td>
</tr>
<tr>
<td>3201</td>
<td>PLOT CURVE, either X or Y not defined.</td>
</tr>
<tr>
<td>3202</td>
<td>not preceded by INITIALIZE.</td>
</tr>
<tr>
<td>3204</td>
<td>TEXT, FONT, illegal font code.</td>
</tr>
<tr>
<td>3205</td>
<td>POSITION, illegal plateral.</td>
</tr>
<tr>
<td>3206</td>
<td>pvertical.</td>
</tr>
<tr>
<td>3241</td>
<td>PLOT CURVE # n, illegal font.</td>
</tr>
<tr>
<td>3301</td>
<td>PLOT CONSTANT X or Y, no xi's or yi's.</td>
</tr>
<tr>
<td>3302</td>
<td>illegal syntax.</td>
</tr>
<tr>
<td>3303</td>
<td>some xi or yi not floating point.</td>
</tr>
<tr>
<td>10000</td>
<td>Unrecognizable command.</td>
</tr>
</tbody>
</table>
Error Message

Each message of the above type is followed by the sequence:

INPUT DATA ERROR, RECORD n
card image echo
FATAL ERROR. NERR, N=EXPX icode

FATAL ERROR. NERR, N=XYLD n  RP.XYLD/15
n=1 - X or Y, invalid source data set vector specified.
=2 - Same as 1
=3 - X or Y, insufficient core to load source data set.

INPUT DATA ERROR, RECORD x  RP.GIDA/9
card image echo

An error was encountered on input record x.
3.25 SYN

**Error Message**

n ADDITIONAL CORE LOCATIONS REQUIRED  
FATAL ERROR. NERR, N=CORE n

FATAL ERROR. NERR, N=CORE n  
RA.LDSS/11A

Core is too small by n words.

FATAL ERROR. NERR, N=CORE n  
RA.LDSYN/11

ILLEGAL INPUT. xxxxx n m  
FATAL ERROR. NERR, N=ILLE 0

n and/or m negative or greater than number of joints.

INPUT DATA ERROR, RECORD n  
FATAL ERROR. NERR, N=ILLE 0

FATAL ERROR. NERR, N=ILLE 0  
RA.LDSS/11A

FATAL ERROR. NERR, N=ILLE 0  
RA.LDSS/11A

FATAL ERROR. NERR, N=ILLE 0  
RA.LDSS/11A

FATAL ERROR. NERR, N=ILLE 0  
RA.LDSS/11A

ILLEGAL CONNECTION xxxxx  
FATAL ERROR. NERR, N=CONN j

j is negative or greater than total number of joints.

REL CONSTRAINT INPUT ERROR. JT6, LB, IERR= x x x  
FATAL ERROR. NERR, N=REL 0

FATAL ERROR. NERR, N=REL 0  
RA.LDSYN/11

FATAL ERROR. NERR, N=REL 0  
RA.LDSS/11A

SUBSTRUCTURE xxxxx, ILLEGAL NRF= n  
FATAL ERROR. NERR, N=NRF 0

SUBSTRUCTURE CANNOT BE PROCESSED  
ADDRESS EXCEEDS UNIVAC LIMIT BY n LOCATIONS  
FATAL ERROR. NERR, N=CORE j
3.26 STRP

Error Message

DET = x
COL = n

Singular matrix, column n.

ERROR. NO ROOTS EXIST ABOVE LOWER FREQUENCY LIMIT
LOWER FREQUENCY LIMIT = x
LARGEST FREQUENCY = x

ILLEGAL I, J = i, j
IREC, K = i, k
FATAL ERROR. NERR, N=ILLE 0

NO ROOTS EXIST IN FREQUENCY LIMIT

SINGULAR MASS MATRIX ENCOUNTERED AT LEVEL n

Spar Routine

RA.STCHOL/8

RA.HAS/10

RA.10/9

RA.KLVT/10
3.27 SSBT

Error Message

CORE AVAIL/REQ = m n
FATAL ERROR. NERR, N=CORE n

Insufficient core. Reset to larger value.

CORE AVAIL/REQ (APPROX) = m n
FATAL ERROR. N=CORE n

Insufficient core. Reset to larger value.

FATAL ERROR. NERR, N=ERR 1

Error in RELC x x x data set.

FATAL ERROR. NERR, N=ERR 2

Error in SYN ECON x x data set, or SYN LOCJ x x data set.

FATAL ERROR. NERR, N=ERR icode

Error codes 11-21 originate in subroutine SBB. A tabulation of these error codes follows.

Code

11 - Problem with SYS JMG x x data set.
12 - " JLOC xxxx x x data set.
13 - " BNG xxxx x x data set.
14 - " BNPC xxxx x x data set.
15 - " BN xxxx x x data set.
16 - " BNF xxxx x x data set.
17 - " FEF xxxx x x data set.
18 - " ALTR xxxx x x data set.
19 - n1 specified on MODES command is negative.
20 - n2 " " " is less than n1.
21 - n2 " " " is greater than NMODES.
Error Message

FG  ALLOCATION.  CORE,  N1-7=  x  x  x  x  x  x  M
FATAL ERROR.  NERR,  N=KORE  n

Insufficient core.  Available = n, required = m.

***  K  FILE  BLOCK  SIZE  INSUFFICIENT.
STAGE,  JOINT,  CONRNG,  LRECA=  x  x  x

Reset LREC to a larger value (default is 2240).
3.29 CEIG

Error Message

n ADDITIONAL CORE REQD. FOR RAYLEIGH-RITZ

ERROR IN RAYLEIGH-RITZ n MODES COMPUTED

FATAL ERROR. NERR, N=CORE n

Insufficient core.

n indicates required data space in words.

FATAL ERROR. NERR, N=CORE -2

Insufficient core. Reset to a larger value.

INPUT DATA ERROR RECORD n
card image echo
FATAL ERROR. NERR, N=ILLE 0

INPUT RVEC, IVEC, RVAL, IVAL INCONSISTENT
FATAL ERROR. NERR, N=INCO modes

LCBD NEEDS n ADDITIONAL WORDS OF CM
FATAL ERROR. NERR, N=CORE n

LCBG NEEDS n ADDITIONAL WORDS OF CM
FATAL ERROR. NERR, N=CORE n

NORMRI NEEDS n ADDITIONAL WORDS OF CM
FATAL ERROR. NERR, N=CORE n

** SINGULAR MATRIX, N, ROW, ZERO= n m xxx

SYSM NEEDS n ADDITIONAL WORDS OF CM
FATAL ERROR. NERR, N=CORE n

** UNSTABLE SPINNING STRUCTURE. EXIT CEIG
Error Message

XTRANS NEEDS n ADDITIONAL WORDS OF CM
FATAL ERROR. NERR, N=CORE n

Spar Routine
RC.XTRANS/12

XTYD NEEDS n ADDITIONAL WORDS OF CM
FATAL ERROR. NERR, N=CORE n
RC.XTYD/12

XTYG NEEDS n ADDITIONAL WORDS OF CM
FATAL ERROR. NERR, N=CORE n
RC.XTYG/12

XUEVL NEEDS n ADDITIONAL WORDS OF CM
FATAL ERROR. NERR, N=CORE n
RC.XUEVL/12
Error Message

*** ADDITIONAL CORE REQUIRED FOR ELEMENT K, NEED = n RJ.K2D/11A

n ADDITIONAL CORE REQUIRED IN DPN

XXXX ALLOCATION. CORE, N1-B= x x x x x x x x x
FATAL ERROR. NERR, N=CORE  n

CM insufficient to begin Phase 2(b).
Increase data space by n words.

CM INSUFFICIENT TO ENTER XPARA
FATAL ERROR. NERR, N=SMA  1000

CM insufficient to begin Phase 2(a).

*ERROR IN TVEC LINE x
FATAL ERROR. NERR, N=SMX1  n

n=1 - J .LT. 1 in a TVEC data set.
     =2 - J .GT. JT in a TVEC data set.
     =3 - K .LT. 1 in a TVEC data set.
     =4 - K .GT. JDF in a TVEC data set.

Where JT and JDF are the number of joints and the
number of degrees of freedom per joint, respectively.

FATAL ERROR. NERR, N=DM  n

n=1 - RMAS data set not present or in error.
     =2 - NJ .NE. JT, or NI .NE. JDF in RMAS.
     =3 - RMAS in error.
     =4 - Illegal RMAS item referenced in a PARA data set.
     =5 - Same as 4.

Where JT and JDF are the number of joints and the
number of degrees of freedom per joint, respectively.
Error Message

FATAL ERROR. NERR, N=DP   1
   CM insufficient to complete Phase 3.

FATAL ERROR. NERR, N=DPX  n
   n=1 - NI or NJ incorrect in DPLI data set.
   =2 - Same as 1.
   =3 - Illegal limits specified in DPLI.

FATAL ERROR. NERR, N=LDSM  n
   n=1 - NPARAS .LT. 1.
   =2 - Neither TVAL nor TVEC present, or
       NI in TVAL .NE. 2, or
       NI in TVEC .NE. 4.
   =3 - CM insufficient to begin Phase 1.

FATAL ERROR. NERR, N=SMA   1
   CM insufficient to begin Phase 2(c).

FATAL ERROR. NERR, N=SMB   1
   CM insufficient to begin Phase 3.

FATAL ERROR. NERR, N=SMC   n
   n=1 or 2 - CM insufficient to complete Phase 4.

FATAL ERROR. NERR, N=SMX   n
   n=1 or 2 - CM insufficient to complete Phase 1.

FATAL ERROR. NERR, N=TCOL  1
   CM insufficient to complete Phase 2(c).
Error Message

FATAL ERROR. NERR, N=XPAR n
n=1 - Non-existent table referenced in a PARA data set.
  =2 - CM insufficient to complete Phase 2(a).
  =3 - Non-existent item referenced in a PARA data set.
  =4 - Same as 3.
  =100 - Same as 1.

FATAL ERROR. NERR, N=YPAR n
Same codes as XPAR.

INPUT DATA ERROR, RECORD n
card image echo
FATAL ERROR. NERR, N=ILLE 0

*** INSUFFICIENT CORE FOR COMPUTING H
n PROVIDED m REQUIRED

K ERROR xxxx ELEMENT x x

*** K FILE BLOCK SIZE INSUFFICIENT.
STAGE, JOINT, CONRNG, LRECA= x x x
Reset LREC to a larger value (default is 2240).

KB ERROR xxxx ELEMENT: x x

NON-POSITIVE DEFINITE K, CURVED BEAM. NERR, ROW= n

PARAMETER DEFINITION ERROR
N3PARA,IPARA,N4,LNE, XF,ITEM1,ITEM2=
  x x x x x xxxxx x x

** SINGULAR SXX MATRIX. ROW, ZERO= i xxx

3-48
Error Message

SPMX NEEDS n ADDITIONAL WORDS OF CM
FATAL ERROR. NERR, N=CORE n

Increase data space by n words.

*** WARNING, H MATRIX IS SINGULAR, ISING = n

XPARA NEEDS n ADDITIONAL WORDS OF CM

XTYG NEEDS n ADDITIONAL WORDS OF CM
FATAL ERROR. NERR, N=CORE n

Spar Routine

RM.SPMX/12

RJ.HGEN/11

RM.XPARA/13

RC.XTYG/12
4. PROGRAM FILE DOCUMENTATION

This section contains information on the SPAR program file contents, processor file requirements, and subroutine/processor cross reference data.

Table 4-1 lists each SPAR program file by number (order in which it resides on the tape), along with its file name and the processor main programs it contains.

Table 4-2 lists the SPAR processors in alphabetical order along with the file containing the MAP symbolic element, the file containing the main program, and other files (if any) required for collecting (MAP'ing) that processor.

Table 4-3 lists the SPAR routines in alphabetical order by subroutine name. Main programs are listed by processor name preceded by MP, e.g. MPAWS. For each routine, the name of the file containing the routine, names of the symbolic and relocatable elements, and the processors which use the routine are listed.
Table 4-1

SPAR PROGRAM FILE CONTENTS

<table>
<thead>
<tr>
<th>File</th>
<th>File Name</th>
<th>Seg #</th>
<th>Processors Contained (main programs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>SPAR15C</td>
<td></td>
<td>DCU</td>
</tr>
<tr>
<td>2</td>
<td>R2</td>
<td></td>
<td>DCU, ELD</td>
</tr>
<tr>
<td>3</td>
<td>R3</td>
<td></td>
<td>DCU, ELD</td>
</tr>
<tr>
<td>4</td>
<td>R4</td>
<td></td>
<td>DCU, ELD, PKMAP, PKMAP, STRP</td>
</tr>
<tr>
<td>5</td>
<td>R5</td>
<td></td>
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5. REFERENCES
