76-05362

File with
N76-13427

#4

STC Program

Vol IV

W/Bond Reproducible

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
NASA CR-132706		

4. Title and Subtitle	5. Report Date
MODIFICATION OF THE STREAMTUBE CURVATURE PROGRAM Volume II - Program Listing	June, 1975
	6. Performing Organization Code
7. Author(s) D.R. Ferguson, J.S. Keith	8. Performing Organization Report No.
	10. Work Unit No.
9. Performing Organization Name and Address General Electric Company Aircraft Engine Group Cincinnati, Ohio 45215	11. Contract or Grant No. NAS1-12891
	13. Type of Report and Period Covered Contractor Report Dec. 1973 - June 1975
12. Sponsoring Agency Name and Address National Aeronautics and Space Administration Washington, D.C. 20546	14. Sponsoring Agency Code

15. Supplementary Notes

Project Manager, E. Boxer, Propulsion Aerodynamics Analysis Section, High Speed Aircraft Division, NASA Langley Research Center, Hampton, Virginia

16. Abstract

This report describes the improvements which have been incorporated in the Streamtube Curvature (STC) Program to enhance both its computational and diagnostic capabilities. In Volume I, detailed descriptions are given of the revisions incorporated to more reliably handle the jet stream-external flow interaction at trailing edges. Also presented are the augmented boundary layer procedures and a variety of other program changes relating to program diagnostics and extended solution capabilities. Volume II consists of the updated User's Manual, and includes information on the computer program operation, usage, and logical structure.

User documentation includes an outline of the general logical flow of the program and detailed instructions for program usage and operation. From the standpoint of the programmer, the overlay structure is described. The input data, output formats, and diagnostic printouts are covered in detail and illustrated with three typical test cases. The program listing is included as a separate document (Volume II).

17. Key Words (Suggested by Author(s))	18. Distribution Statement
Streamtube Curvature Computer Program User's Manual Transonic Flow Inlets, Nacelles, Nozzles	

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price*
Unclassified	Unclassified	322	

* For sale by the National Technical Information Service, Springfield, Virginia 22151

NASA-C-168 (Rev. 6-71)

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Concluded)

This appendix to the User Manual for the Streamtube Curvature Analysis contains the computer program listing. It should be noted that the listing includes explanatory statements and titles so that the program flow is readily discernable. The computer program listing is in CDC Fortran 2.3 source language form, except for three subroutines, GETIX, GETRLX, and SAVIX, which are in Compass 1.1 language.

```
*DECK MAIN
      OVERLAY(STC,0,0)
      PROGRAM STCA(INPUT,OUTPUT,TAPE5,TAPE6=OUTPUT,
     * TAPE1,TAPE2,TAPE4=TAPE2)
      COMMON /BCOMMN/ PROGM,TAPIN,TAPOT,REF(5),PROGSV,FILIN,FILOT
       LOGICAL      TAPIN,TAPOT,                FILIN,FILOT
      EQUIVALENCE (IPROGM,PROGM)
      COMMON /ADAM01/ NAME(6),ADDRES(6),TITLE(6),IDENT(6)
      COMMON /ADAM02/ ENDJOB,DUM1(2),ENDCRD
      LOGICAL         ENDJOB,         ENDCRD
      COMMON /CBITS / BITS,BLANK
       EQUIVALENCE    (IBLANK,BLANK)
      COMMON /CGRAV / CG
      COMMON /CNTRL / K5(8),CARRY,ICHN
       LOGICAL              CARRY
      COMMON /IXORIG/ IIDUM(21),NM,IIIDUM(11)
      COMMON /KEYS  / KEYA(11),KEYB(11),KODA(22)
       DIMENSION      XKEYA(11)
      EQUIVALENCE (XKEYA(1),KEYA(1))
      COMMON /TROUBL/ ERR,ERRMAJ,INERR,PRERR
       LOGICAL        ERR,ERRMAJ,INERR,PRERR
C
      COMMON /ADJWF1/  MODE,LFF,MODEO,LFO
      COMMON /CINNER/ INRCTR,RDUM,NINNER(16),CNVF(16)
      COMMON / CMAX4 / ES2MX, ZMX, RMX, DS2MX,  LDUMY
      COMMON /CMAXIT/ MAXIT,MAJCTR,GREFIN,EDUM
       LOGICAL                     GREFIN
      COMMON /CPRINT/ PPDUM(6),PDUM(20)
      COMMON /CSTALO/ NSSPTS
      COMMON /CTAPOS/ RESTRT,ENDBDT,STCFIL,K6SV
       LOGICAL        RESTRT,ENDBDT,STCFIL
      COMMON / CTE   / TOLWF, TOLWFU, TEXI2, TWF, TERWF, JRET
      COMMON /CTOLRL/ TOLRL,MAXSWP,CLEN,DMDS2,TOLES2,NSWP,
     1                DS1DMP,DS1MXA,DS1MXB,DS1RMS,DMES2,DS1RM0
     *,               SG1REF,TOLINR
C     DS1DMP= DAMPING FACTOR ON DS1, =0 FOR NO DAMPING,  =1 FOR NOMINAL
C     DS1MXA= MAX-DS1
C     DS1MXB= MAX CALCULATED DS1 BEFORE DAMPING
C     DS1RMS= RMS OF THE CALCULATED DS1-S
C     ES2MX = MAX SL POSITION ERROR AS DETERMINED BY THE FLOW BALANCE
C                   NOW STORED IN COMMON / CMAX4 /-
C     DS2MX = MAX CALCULATED SL ADJUSTMENT
C                   NOW STORED IN COMMON / CMAX4 /-
C     NSWP  = NUMBER OF LRELAX SWEEPS
      COMMON /TAPES / NTAPO,NTAPN
      DIMENSION AA(8)
      COMMON /SELECT/  LENTRY
      DATA KA/1HA/, KBDY/3HBDY/, STC/3HSTC/
      DATA ITRUE/1HT/

      NTAPO = 1
      NTAPN = 2
      WRITE (6,7760)
 7760 FORMAT(1H1,22X,28H* * C A R D    I N P U T * *//)
C    INITIALIZE--- AFTER READING NAMELISTS ID,DIP
      ENDFILE 5
      REWIND 5
 7777 FORMAT(1H1)
 7778 FORMAT(8A10)
 7775 READ (5,7778) AA
      IF( EOF,5 ) 7781,7776
 7776 WRITE (6,7778) AA
```

```
      GO TO 7775
7781  REWIND 5
      READ(5,1001) NAME
      READ(5,1001) ADDRES
      READ(5,1001) IDENT
1001  FORMAT (1X,6A10)
      READ (5,1002) IN1,PROGM,TAPIN,TAPOT
1002  FORMAT (I2,1X,A10,L1,9X,L1)
   11 WRITE (6,1100) PROGM,TAPIN,TAPOT
1100  FORMAT (1H1,10X,16HEXECUTING PROGM=,A6/10X,6HTAPIN=,L2,5X,
     * 6HTAPOT=,L2/)
      XKEYA(4)= PROGM
      PROGSV= PROGM
      ENDCRD= .FALSE.
      ERRMAJ= .FALSE.
      PRERR = .FALSE.
      DO 2 I=1,3
      KEYA(I)= IBLANK
    2 KEYB(I)= IBLANK
    3 FILIN = TAPIN
      FILOT = TAPOT
      TAPIN = .FALSE.
      TAPOT = .FALSE.
      ERR   = .FALSE.
      DATA IBDY/3HBDY/
      K5    = IBDY
    4 PROGM = BITS
    8 K5    = KA
      GO TO 12
C     CONSECUTIVE DIP LIST READ
    5 READ (5,1003) IN1,IN2,IN3,IN4
 1003 FORMAT(I2,1X,3A10)
      IF(EOF,5) 19,7

    7 GO TO (20,9,10),IN1
    9 K5    = KBDY
      K5(2) = IN3
      ICHN  = IN4
      GO TO 12
   10 K5    = IN2
      K5(2) = IN3

C     INPUT SECTION----- ENTRY STCN TO (1,0)
   12 LENTRY= 1
      LOVER = 1
      CALL OVERLAY(3HSTC,1,0,6HRECALL)
      IF((.NOT.INERR) .AND. (.NOT.ERR) ) GO TO 5
   15 WRITE (6,1004) LOVER,LENTRY
 1004 FORMAT (//2X,9HERR    = T,5X,7HERRCOD=,I2,5X,7HLENTRY=,I2)
      CALL ERRORK(6HERR=T )
      WRITE (6,1000)
 1000 FORMAT(1H1//10X,26H***** JOB TERMINATED *****)
      STOP
   19 ENDJOB= .TRUE.

C     INPUT PROCESSING COMPLETE-- BUILD TABLES
   20 LENTRY= 2
      LOVER = 1
      CALL OVERLAY(3HSTC,1,0,6HRECALL)
      IF(ERR) GO TO 15
      CALL FHEAD
```

```
      WRITE (6,1140)
      RESTRT=.TRUE.

C   REFINE,  INNER LOOP INITIALIZATION
  210 LFF    =0
      DS2MX = BITS
      NSWP  = 0
      GREFIN= .TRUE.
      INRCTR= 0
      IF(RESTRT) GO TO 215
      LOVER = 3
      LENTRY=1
      CALL OVERLAY(3HSTC,3,0,6HRECALL)
      IF(ERR) GO TO 15
      IF(.NOT.GREFIN) GO TO 230
      MAJCTR= MAJCTR+1
C
C  BEGIN INNER ITR LOOP, CALC STREAMLINE CURVATURE
C  ORTHOGONALIZE (SE220)
  215 RESTRT= .FALSE.
      LOVER = 3
      LENTRY= 2
      CALL OVERLAY(3HSTC,3,0,6HRECALL)
      IF(ERR) GO TO 15
C     ADJUST FLOWS AT CHOKED STATIONS
      TEXI2 = BITS
      TWF   = BITS
      TERWF = BITS
      LFO   = 0
      MODE0 = 0
      LOVER = 2
      LENTRY= 1
      CALL OVERLAY(3HSTC,2,0,6HRECALL)
      IF (ERR) GO TO 15
C
C  PERFORM FLOW BALANCE, BEGIN FLOW ADJUSTMENT LOOP
  227 LOVER = 2
      LENTRY= 4
      CALL OVERLAY(3HSTC,2,0,6HRECALL)
      IF(ERR) GO TO 15
      AES2MX = ABS ( ES2MX )
      ES2LIM = SG1REF * TOLINR
      FES2LM = CLEN * TOLES2
      IF(MAJCTR.GE.MAXIT .OR. .NOT.GREFIN) ES2LIM = FES2LM
      TOLWFU = TOLWF
      IF(AES2MX.GE.ES2LIM .OR. MAJCTR.EQ.0) GO TO 228
      MODE  = -1
      LENTRY = 3
      CALL OVERLAY(3HSTC,2,0,6HRECALL)
      IF(ERR) GO TO 15
  228 TWFP  = TWF/CG
      TERWFP = TERWF/CG
      IF(TEXI2.EQ.BITS) GO TO 2303
      WRITE (6,1252) MAJCTR,NM,INRCTR,NSSPTS,NSWP,DS2MX,ES2MX,
     1 ES2LIM,ZMX,RMX,TEXI2,TWFP,TERWFP
      GO TO 230
 2303 WRITE(6,1252) MAJCTR,NM,INRCTR,NSSPTS,NSWP,DS2MX,ES2MX,ES2LIM,
     2        ZMX,RMX
  230 MCTR  = MAX0(1,MAJCTR)
      IF(INRCTR.GE.NINNER(MCTR)) GO TO 232
```

```
      IF(.NOT.GREFIN) ES2LIM=CLEN*TOLES2
      IF ( INRCTR .EQ. 0 .OR.  AES2MX .GE. ES2LIM ) GO TO 240
C      ES2 CONVERGED
      IF(MODE.EQ.3 .OR. MAJCTR.EQ.00) GO TO 232
      MODE  = 1
      LENTRY = 3
      CALL OVERLAY(3HSTC,2,0,6HRECALL)
      IF ( MODE-2 ) 231,231,232
  231 DS2MX  = BITS
      NSWP  = IBITS
      TEXI2 = BITS
      TWF   = BITS
      TERWF = BITS
      GO TO 227
C      ES2 AND FLOW ADJ ARE CONVERGED
  232 IF(MAJCTR.GE.MAXIT .OR. .NOT.GREFIN) GO TO 300
      GO TO 210

C  MATRIC SOLUTION
  240 LOVER = 4
      CALL OVERLAY(3HSTC,4,0)
      IF(ERR) GO TO 15
C  ADJUST STREAMLINES
  250 LOVER = 3
      LENTRY= 3
      CALL OVERLAY(3HSTC,3,0,6HRECALL)
      IF(ERR) GO TO 15
      INRCTR= INRCTR+1
      GO TO 215

C  ES2 AND FLOW ADJ CONVERGED, REFINEMENT SATISFIED
  300 LOVER = 2
      LENTRY= 2
      CALL OVERLAY(3HSTC,2,0,6HRECALL)
      IF(PDUM(10).EQ.2.) CALL EDUMPS
      IF(ERR) GO TO 15
      IF(ENDJOB) GO TO 100
      IF( IN3.EQ.ITRUE ) TAPIN=.TRUE.
      IF( IN4.EQ.ITRUE ) TAPOT=.TRUE.
       IPROGM= IN2
      GO TO 11
C
  100 WRITE (6,2000)
 2000 FORMAT (1H1//10X,26H********* ENDJOB *********)
 1140 FORMAT (1H0,55X,19HSOLUTION    HISTORY/
     1 55X,21H---------------------//
     2 2X,121HREFINEMENT   +  INNER ITERS  +  MATRIX  SOLUTION  +  - -
     3       FLOW  BALANCE  ERROR      - -  +          KUTTA   ITERATION/
     4 100X,31HTRAILING     FLOW      FRACTIONAL/
     5 1X,130HNREFIN   GRID   INRCTR  NSSPTS  NSWEEPS    MAX-DS2    MAX-
     6ES2      LIM-ES2          Z            R          EDGE-XI2    RATE      FLOW
     7 ERROR/
     8 30H                PTS                 /)
 1252 FORMAT (I5,6X,I3,5X,I2,4X,I4,6X,I3,4X,F9.6,2X,F9.6,2X,F9.6,
     1 3X,F8.3,3X,F8.3,6X,F4.0,4X,F9.4,4X,F7.4)
      STOP
      END
```

```
*DECK USECDG
      BLOCK DATA USECDG
*USECDG         REPLACE LFIELD USE CARDS
      COMMON /ALLCOM/ C1(24)
      COMMON /CAO    / AO
      COMMON /CPRINT/ C32(26)
      COMMON /CTHICK/  C7(302)
      COMMON /CIDEX / C5(6)
      COMMON /CFRFIN/ C3(6)
      COMMON /CBEAM2/ C30(20)

      COMMON /CDS2  / C12(900)
      COMMON /CRHS  / RHS(768)

      COMMON /CHDATA/ C9(2200)
      COMMON /CEND  / C2(2)
      COMMON /CCURV / CURV(768)
      COMMON /CPHI1 / PHI1(768)
      COMMON /CS1   / S1(768)
      COMMON /CS2   / S2(768)
      COMMON /SLTAB / C8(384)
      COMMON /CM    / JMS(768)

      COMMON /CB    / B(768)
      COMMON /CZ    / Z(768)
      COMMON /CR    / R(768)
      COMMON /CVM   / VM(768)
      COMMON /CFRFLD/ C4(830)
      COMMON /ERASE2/ C31(1536)
      END
```

```
DECK BLBLOK
      BLOCK DATA BLBLOK
      COMMON /IXORIG/ IDUM1(14),LDO,LDE,IDUM2(17)
      COMMON /BLBDW / IBLB(60)
      COMMON /VISCOS/ TREF,MUREF,SCON
      REAL                   MUREF
      COMMON /REBL  / RESTBL
      LOGICAL         RESTBL
      DATA IBLB/60*0/
      DATA TREF,MUREF,SCON/518.,688,10.E-7,198.6/
      DATA LDO,LDE/1,0/
      DATA RESTBL/F/
      END
```

```
*DECK STCBLK
      BLOCK DATA STCBLK
*STCBLK          STC  BLOCK DATA                              'STCBLK'

      COMMON /ALLCOM/ MACHA,PSA,TSA,PTA,TTA, AXIA,RGA,GAMA,
     &                MACHC,PSC,TSC,PTC,TTC, AXIC,RGC,GAMC,
     &                DAXIT,SCALEA,TTE,CHOTST
       LOGICAL        AXIA,AXIC,CHOTST
       REAL           MACHA(1),MACHC
      COMMON /BENDIN/ NBCIN(2),ACF(2)
      COMMON /CBITS / BITS,BLANK
      COMMON /CCRX  / CRXSL,CRXOL,CRXSS,CRXE,CRXC,DCRX
       DIMENSION      CRX(6)
       EQUIVALENCE    (CRX,CRXSL)
      COMMON /CFB2  / PASS1
       LOGICAL        PASS1
      COMMON /CGRAV / CG
      COMMON /CIADIN/ RHOBAS,RHOAMP,IADM
      COMMON /CINNER/ INRCTR,RDUM,NINNER(16),CNVF(16)
      COMMON /CISBOT/ FARFLD(2),FREE(2),PRES(2),PSPISV,NZP,
     &                ZP(10),PSP(10),NZP1,DISBOT,ADUM(6)
       INTEGER        FARFLD,FREE,PRES,PSPISV
      COMMON /CIVP  / IVP,VPDUM,NRF(2),INR(2),XIVP(2)
     &,               MXLRLX
      COMMON /CLINES/ LINES,OMITFK,PTITLE(6)
      COMMON /CMAXIT/ MAXREF,NREFIN,GREFIN,TL
      COMMON/CNORM / RHL,RM,AHL,ARM
      COMMON /CPI   / PI,TWOPI,PIO2,PIO4,TODEG,TORAD
      COMMON /CPRPRN/ PRPRN
       INTEGER        PRPRN
      COMMON /CPTMOV/ VELPOT,ICOB,NODENS,FBASTG
       LOGICAL        VELPOT
      COMMON /CREFIN/ DREFIN,SG21,VMG1,VMG2, NGR,NGZ,SGR(10),GR(10),
     &                SGZ(10),GZ(10)
       DIMENSION      G40(40)
       EQUIVALENCE    (G40,SGR)
      COMMON /CSLC  / BRANCH(4)
      COMMON /CSS   / SSFML,SSEF,SSEANG,SSDF,SSFEND,SSFND1,
     &                DSS(2),RHOW,RHOWSS,TSIC,RHOC,RHOCSS
       INTEGER        SSFML
       LOGICAL                SSEF,       SSDF
      COMMON /CTE   / TOLWF,TOLWFU,TEXI2,TWF,TERWF,JRET
      COMMON /CTOLRL/ TOLRL,MAXSWP,CLEN,DTOLR1,TOLES2,NSWP,
     &                DS1DMP,DS1DP1,DTOLR2(4),SG1REF,TOLINR
      COMMON /IXORIG/ LHO,LHE, LBDO,LBDE, LTO,LTE, LWO,LWE, LFO,LFE,
     &                LO,LESTA,LSO,LSE,LDUM(6),
     &                MO,NM, NJ,NFCOLS, MAXNJ,MAXOL,MAXNM,MAXLE,
     &                LEO,LEE, LRO,LRE,LRD
      COMMON /SLTAB2/ PTR(128)

C  COMMONS NOT PRESENT IN GE VERSION
      COMMON /CBEND / NBCB(2),ANGE(2),CURVE(2),FB(2)
      COMMON /CBOW  / BSHOCK,DUMBS(8)
       LOGICAL        BSHOCK
      COMMON /CCUBE / NBC(2),C1(2),C2(2),FEND(2)
      COMMON /CEDUMP/ IGODMP
      COMMON /CLFIT1/ LFOUT
       LOGICAL        LFOUT
      COMMON /CPRINT/ PPK(6),PDUM(20)
      COMMON /LINMAX/ LMAX
      DATA MACHA/O377777777777777/, PSA,PTA/2*14.696/, TSA,TTA/2*518.7/,
     &     AXIA/.TRUE./, RGA/1716.2/, GAMA/1.4/, SCALEA/1./,
```

```
     &        TTE/0./, CHOTST/.TRUE./
      DATA NBCIN/2*2/, ACF/0.,0./
      DATA BITS/037777777777/, BLANK/1H /
      DATA CRX/.375,.375,.125,0.,0.,0./
      DATA PASS1/.TRUE./
      DATA CG/32.174/
      DATA RHOBAS,RHOAMP,IADM/.5,.5,0/
      DATA NINNER/16*10/,CNVF/16*1./
C  GE LINES DELETED
      DATA PSPISV,NZP,NZP1/0,0,0/
C     NOTE - ADUM(1) IS USED TO EXTEND FAR FIELD BOUNDARY
      DATA NRF/1,0/,INR/1,0/, XIVP/1.E6,0./, MXLRLX/5/
C  GE LINE DELETED
      DATA TL/1.E6/
      DATA RN/0./
      DATA PI/3.14159265/, TWOPI/6.2831853/, PIQ2/1.57079632/,
     &        PIQ4/.78539816/, TODEG/57.2957795/, TORAD/.0174532925/
      DATA PRPRN/0/
      DATA VELPOT/F/,ICOB/-1/, NODENS/0/,FBASTG/0./
      DATA G40/40*037777777777/, NGR/1/,
     &        VMG1,VMG2/100.,100./, SGR/10.,9*0./, SG21/1./
      DATA BRANCH/6*999./
      DATA SSFML/1/, SSEF/.FALSE./, SSEANG/0./, SSDF/.FALSE./
     &,       SSFEND,SSFND1/.75,.75/, TSIC/2./,
     &        RHOW,RHOWSS,RHOC,RHOCSS/1.,1.,1.,1./
      DATA TOLWF/.001/
      DATA TOLRL/1.E-3/, MAXSWP/200/ , TOLES2/1.E-3/,
     &        DS1DMP,DS1DP1/0.,.5/, SG1REF/0./, TOLINR/.05/
      DATA LHO,LHE/1,0/, MO,NM/1,0/, NFCOLS/20/, MAXNJ,MAXOL/128,96/,
     &        LEO,LEE/1,0/, LRO,LRE/1,0/
      DATA PTR/128*1./
C
C  DATA DIFFERENT FROM OR NOT PRESENT IN GE VERSION
      DATA MACHA/1.E15/,PSA,PTA/2*14.696/,TSA,TTA/2*518.7/
      DATA PSA,PTA,TSA,TTA,RG/5*1./
      DATA BITS/1.E15/
      DATA (FARFLD(I),I=1,2)/10HFF        ,10H          /
      DATA (FREE(I),I=1,2)/10HFREE1     ,10HFREE2     /
      DATA (PRES(I),I=1,2)/10HPRES1     ,10HPRES2     /
      DATA ADUM/.25,5*0./
      DATA (PTITLE(I),I=1,6)/6H      ,6H  STRE,6HAMTUBE,6H CURVA,
     & 6HTURE P,6HROGRAM/
      DATA G40/40*1.E15/,VMG1,VMG2/.1,.1/
      DATA NGZ/0/, SGZ/10*0./, DREFIN/.01/
      DATA DS1DMP/.02/, SGIREF/10.E6/
C
      DATA BSHOCK/F/
      DATA NBC/2*0/,C1,C2,FEND/2*0.,2*0.,2*0./
      DATA IGODMP/1/
      DATA LFOUT/F/
      DATA PPK/6*0./,PDUM/0.,1.,0.,1.,16*0./
      DATA LMAX/64/
      END
```

```
*DECK EDUMPS
      SUBROUTINE EDUMPS
*EDUMPS          TERMINAL EDUMP                    'EDUMPS'
      SUBROUTINE EDUMPS

      COMMON /CHDATA/ TABLES(1),LNEXT(1),MLB(1),MUB(97)

      COMMON /CB    / B(300)
      COMMON /CCURV / CURV(300)
      COMMON /CDS2  / DS2(300)
      COMMON /CIDEX / M,J,MU,MD,ISTAG
      COMMON /CLINES/ LINES,OMITFK,PTITLE(6)
       LOGICAL        OMITFK
      COMMON /CM    / JMS(300)
      COMMON /CPHI1 / PHI1(300)
      COMMON /CR    / R(300)
      COMMON /CRHS  / RHS(300)
      COMMON /CS1   / S1(300)
      COMMON /CS2   / S2(300)
      COMMON /CTABPR/ I1TAB
      COMMON /CVM   / VM(300)
      COMMON /CZ    / Z(300)
      COMMON /IXORIG/ LHO,LHE, LBDO,LBDE, LTO,LTE, LWO,LWE, LFO,LFE,
     &                LO,LESTA,LSO,LSB,LDUM(6),
     &                MO,NM, NJ,NFCOLS, MAXNJ,MAXOL,MAXNM,MAXLE,
     &                LEO,LEE, LRO,LRE,LRD

      I1TAB = LWO
      CALL TABPRT(6HWAKETB,TABLES,LWE,2)
      I1TAB = LFO
      CALL TABPRT(6HCADJWF,TABLES,LFE,8)
      I1TAB = LO
      CALL TABPRT(6HSTATAB,TABLES,LESTA,5)
      L      = LO
      LMAX   = LESTA
      OMITFK= .TRUE.
      LINES = 64
 190  MA     = MLB(L)
      MB     = MUB(L)
      CALL FHEAD(MB-MA+2)
      IF (LINES.EQ.(MB-MA+5)) WRITE (6,1200)
      WRITE (6,1202)
      DO 200 M=MA,MB
      CALL GETIX
      WRITE (6,1201) J,M,MU,MD,ISTAG, S1(M),S2(M),Z(M),R(M),PHI1(M),
     &          CURV(M),VM(M),B(M),RHS(M),DS2(M)
 200  CONTINUE
      L      = L+LNEXT(L)
      IF(L.LE.LMAX) GO TO 190
 1200 FORMAT(57X,16HFIELD TABLE DUMP/128H    J      M     MU    MD I     S1
     &     S2               Z                R              PHI1          CURV              V
     &M               B        RHS          DS2)
 1201 FORMAT (1X,I5,3I5,I2,2F11.6,2F12.6,F11.6,F12.7,2F11.3,2F10.5)
 1202 FORMAT(1H )
      RETURN
      END
```

```
*DECK ERRORK
      SUBROUTINE ERRORK(NAME)
      COMMON /ALLCOM/ MACHA,PSA,TSA,PTA,TTA, AXIA,RGA,GAMA,
     1                MACHC,PSC,TSC,PTC,TTC, AXIC,RGC,GAMC,
     2                DAXIT,SCALEA,TTE,CHOTST
        REAL          MACHA(1),MACHC
        LOGICAL       AXIA,AXIC
        LOGICAL       CHOTST
      COMMON /ERASE2/ AREA(96),AREAD(96),DISP(96),PT(96),LAMBDA(96),
     1                RHO(96),SQRTVV(96),TS(96),TT(96),VMSQ(96),
     2                VVKQKP(96),
     2                WQA(96),WSTA(96), RG(96),C2CP(96),FGR(96)
        REAL          LAMBDA
        DIMENSION     ES2(96),SDNQRM(96)
        EQUIVALENCE   (ES2,VVKQKP),(SDNQRM,RHO)
        DIMENSION     RCU(96)
        EQUIVALENCE   (RCU,LAMBDA)
C     FIELD TABLES
C       INDEX- M=MO,NM
       COMMON /CZ    / Z(300)
       COMMON /CR    / R(300)
       COMMON /CS2   / S2(300)
       COMMON /CS1   / S1(300)
       COMMON /CPHI1 / PHI1(300)
       COMMON /CM    / JMS(300)
       COMMON /CCURV / CURV(300)

       COMMON /CB    / B(300)
       COMMON /CRHS  / RHS(300)
       COMMON /CDS2  / DS2(300)
       COMMON /CEDUMP/ IGODMP
       COMMON /CIDEX / M,J,MU,MD,ISTAG
C     TABLE OF INDEX LIMITS
       COMMON /IXORIG/ LHO,LHE, LBDO,LBDE, LTO,LTE, LWO,LWE, LFO,LFE,
     *                LO,LESTA,  LDUM(8),
     *                MO,NM, NJ,NFCOLS, MAXNJ,MAXOL,MAXNM,MAXLE,
     *                LEO,LEE, LRO,LRE,LRD
        DIMENSION     LIMITS(24)
        EQUIVALENCE   (LIMITS,LHO)
       COMMON /CVM   / VM(300)

C     STREAMLINE TABLE
       COMMON /SLTAB / W(128),X2(128),SLCHN(128)
        INTEGER SLCHN
C     BOUNDARY TABLE
C      INDEX- LB=LBDO,LBDE
C      LBNEXT= INCREMENT TO NEXT BOUNDARY
C      LBZ1  = INCREMENT TO THE FIRST BOUNDARY POINT (=0 BEFORE COALLATIO
C      CHNAME= CHANNEL WITH WHICH THE BOUNDARY DATA IS ASSOCIATED
C      UP    = T OR F FOR UPPER OR LOWER BOUNDARY
C      LEDEX = RELATIVE INDEX OF L.E. POINT WHEN LOWER AND UPPER SURFACE
C              CONTOURS ARE CONNECTED
C      BDNAME,LBA,LBB=NAME AND INDEX LIMITS OF SPECIFIC BOUNDARY
C                     DATA WHEN BOUNDARIES ARE COALLATED
        DIMENSION     BDT(1),LBNEXT(1),LBZ1(1),
     1                CHNAME(1),UP(1),LEDEX(1),
     2                ZBT(1),RBT(1),ANGBT(42)
        LOGICAL       UP
        INTEGER BDT,CHNAME,BDNAME
        DIMENSION     BDNAME(1),LBA(1),LBB(1)
        EQUIVALENCE   (BDNAME,ZBT), (LBA,RBT), (LBB,ANGBT)
C     FLOW ADJUSTMENT TABLE
```

```
C      INDEX- LF=LFO,LFE
C      NFCOLS= 8
C      X1F    = ORTHOGONAL COORDINATE
C      X2F    = STREAMLINE COORDINATE OF SL EMINATING FROM T.E.
C      X1BF   = X1-COORDINATE OF CHOKE STATION OF FLOW BELOW T.E.
C      X1AF   = X1-COORDINATE OF CHOKE STATION OF FLOW ABOVE T.E.
C      S1F    = S1-COORDINATE OF T.E. (UPPER SURFACE), THIS ITEM
C               IS USED WHEN INTERPOLATING FOR WAKE DELTA-STAR.
C      LFB,LFA=INDICES OF STATIONS BELOW AND ABOVE T.E.
C      NCHB,NCHA=NUMBER OF CHANNELS BELOW AND ABOVE T.E.
C      LRF    = INDEX OF DUMMY ORTCHN LIST FOR THE T.E.
C      LRXF   = INDEX OF LAST CHANNEL BELOW THE T.E.
C      JORDER= 0 IF TOTAL FLOW AT X1F IS GIVEN
C            = 2 IF FLOW ABOVE T.E. IS GIVEN
C            = 1 IF FLOW BELOW T.E. IS GIVEN
C      JORDER= -1 IF FLOW AT X1F IS CHOKED AND SINGLE CHANNEL
       DIMENSION          X1F(1),X2F(1),X1BF(1),X1AF(1),
     1                    S1F(1),NCHB(1),NCHA(1),JORDER(1),VNR(12)
       EQUIVALENCE        (LFB,X1BF),(LFA,X1AF),(LRF,NCHB),(LRXF,NCHA)
       DIMENSION          LFB(1),LFA(1),LRF(1),LRXF(1)
C     STATION TABLE
C      INDEX- L=LO,LESTA
C      SCHOKE= STATION CHOKE INDICATOR (ADJWF,BRHS,WRIOUT)
C      MCL    = SHARP CORNER INDICATOR (BLDTBS)
C      MCL    = FIELD INDEX OF CONTROL STREAMLINE (PTMOVE,FLOBAL)
       COMMON /CHDATA/ X1(1),LNEXT(1),MLB(1),MUB(1),PRIM(1),
     1                    TYPELB(1),NAMELB(1),ILB(1),FLB(1),S1LB(1),
     1                    TYPEUB(1),NAMEUB(1),IUB(1),FUB(1),S1UB(1),
     3                    VMB(1),DWDV(1), X2CL(1),VCL(1),MCL(481)
       LOGICAL            PRIM
       DIMENSION          SCHOKE(1)
       EQUIVALENCE        (SCHOKE,DWDV)

       EQUIVALENCE    (BDT,X1F,X1), (LBNEXT,X2F,LNEXT), (LBZ1,X1BF,MLB)
       EQUIVALENCE    (CHNAME,X1AF,MUB), (UP,S1F,PRIM)
       EQUIVALENCE    (LEDEX,NCHB,TYPELB), (ZBT,NCHA,NAMELB)
       EQUIVALENCE    (RBT,JORDER,ILB), (ANGBT,VNR,FLB)

       COMMON /CTABRR/ I1TAB

       WRITE (6,100) NAME
   100 FORMAT(//2X,13HERRORK CALL--,1A6//)

       CALL TABPRT(6HALLCOM,MACHA,20,8)
       I1TAB = LBDO
       CALL TABPRT(6HBDYTAB,BDT,LBDE,3)
       I1TAB = LFO
       CALL TABPRT(6HCADJWF,X1F,LFE,8)
       I1TAB = LO
       CALL TABPRT(6HSTATAB,X1,LESTA,5)
   150 WRITE (6,1150) (J,X2(J),SLCHN(J),W(J),J=1,NJ)

       L      = LO
       LMAX   = LESTA
   180 OMITFK= .TRUE.
       LINES  = 64
   190 MA     = MLB(L)
       MB     = MUB(L)
       CALL FHEAD(MB-MA+2)
       IF (LINES.EQ.(MB-MA+5)) WRITE (6,1200)
       WRITE (6,1202)
```

```
      DO 200 M=MA,MB
      CALL GETIX
      WRITE (6,1201) J,M,MU,MD,ISTAG, S1(M),S2(M),Z(M),R(M),PHI1(M),
     1          CURV(M),VM(M),B(M),RHS(M),DS2(M)
  200 CONTINUE
      L      = L+LNEXT(L)
      IF(L.LE.LMAX) GO TO 190


C  ERASE2 DUMP
  300 NK     = MIN0(NK,96)
      GO TO (400,310,330,350,360),IGODMP
  310 WRITE (6,1000)
      DO 315 I=1,NK
      WRITE (6,1001) (AREA(J),J=I,672,96)
  315 CONTINUE
      WRITE (6,1002)
      DO 320 I=1,NK
      IP     = 672+I
      WRITE (6,1001) (AREA(J),J=IP, 1536,96)
  320 CONTINUE
      GO TO 400

  330 WRITE (6,1003)
      I        = 0
      L        = LNEXT(LO)
      DO 335 IL=LO,LESTA,L
      I        = I+1
      WRITE (6,1001) (AREA(J),J=I,768,128)
  335 CONTINUE
      WRITE (6,1005)
      DO 340 I=1,NK
      IP     = 768+I
      WRITE (6,1006) (AREA(J),J= IP,1248,96)
  340 CONTINUE
      GO TO 400

  350 WRITE (6,1007) (AREA(I),I=1152,1183)
      WRITE (6,1009)
      I        = 0
      L        = LNEXT(LO)
      DO 355 IL=LO,LESTA,L
      I        = I+1
      WRITE (6,1010) (AREA(J),J=I,1152,128)
  355 CONTINUE
      GO TO 400

  360 WRITE (6,1011) (AREA(I),I=1024,1037)
      WRITE (6,1012)
      I        = 0
      L        = LNEXT(LO)
      DO 365 IL=LO,LESTA,L
      I        = I+1
      WRITE (6,1013) (AREA(J),J=I,1024,128)
  365 CONTINUE
  400 CONTINUE

 1000 FORMAT (//2X,40HSUBROUTINES BRHS, FLOBAL, WRIBDY, WRIOUT//
     1         11X,4HAREA,8X,5HAREAO,9X,4HDISP,11X,2HPT,7X,6HLAMBDA,10X,
     2         3HRHS,7X,6HSQRTVV)
 1001 FORMAT (2X,9E13.5)
```

```
1002 FORMAT (//13X,2HTS,11X,2HTT,9X,4HVMSQ,7X,6HVVKQKP,10X,3HWQA,9X,
    1        4HWSTA,11X,2HRG,9X,4HC2CP,10X,3HFGR)
1003 FORMAT (//2X,17HSUBROUTINE PTMOVE// 12X,3HX1L,11X,2HSC,11X,2HVC,
    1        10X,8HVDS,9X,4HFVDS,10X,3HSCX)
1005 FORMAT (//11X,4HPHI2,10X,3HDS1,11X,2HZK,11X,2HRK,2X,5HWEZPT)
1006 FORMAT (2X,4E13.5,5X,L2)
1007 FORMAT (//2X,17HSUBROUTINE REFINE//2X,3HIA=,16I7/2X,3HIB=,16I7)
1009 FORMAT (//13X,2HCR,9X,4HDELS,8X,5HDELVM,2X,4HLSTA,3X,3HMJ2,10X,
    1        3HSQX,10X,3HSQY,10X,3HRAV,10X,3HZAV)
1010 FORMAT (2X,3E13.5,2I6,4E13.5)
1011 FORMAT (//2X,14HSUBROUTINE SLC//2X,6HCURSS=,6E13.5/
    1        2X,6HQV    =,8E.3.5)
1012 FORMAT (//13X,2HRB,11X,2HZB,10X,3HANG,8X,5HCURVB,10X,3HS1B,11X,
    1        2HBI,2X,6HJ2DONE,3X,3HMSV)
1013 FORMAT (2X,6E13.5,2X,2I6)
1202 FORMAT (1H )
1201 FORMAT (1X,I3,3I5,I2,2F11.6,2F12.6,F11.6,F12.7,2F11.3,2F10.5)
1200 FORMAT (57X,16HFIELD TABLE DUMP/128H   J     M    MU    MD I    S1
    *      S2                Z                R              PHI1          CURV
    *VM              B      RHS         DS2 )

     LSTOP = 5
     IF(LSTOP.EQ.5) STOP
     RETURN
1150 FORMAT(///1X17HSTREAMLINE TABLE-/17X32HJ         X2              SLCHN
    *     W/(I18,F12.6,6X,A6,F12.6,),)
     END
```

```
*DECK ATAN3
      FUNCTION ATAN3(DY,DX,ANGREF)
*ATAN3*          ARCTAN FUNCTION WITH REFERENCE ANGLE        *ATAN3*

C     LIMITS ARE-           (-PI) .LE. (ATAN3-ANGREF) .LT. (+PI)

      COMMON /CATAN3/ DANG
      COMMON /CPI   / PI,TWOPI
      DATA KNAME/6HATAN3 /

      ANG    = ATAN2(DY,DX)
      N      = 20
   50 N      = N-1
      IF(N.EQ.0) CALL ERRORK(KNAME)
      DANG   = ANG-ANGREF
      IF(PI-DANG) 60,70,70
   60 ANG    = ANG-TWOPI
      GO TO 50
   70 IF(DANG+PI) 80,90,90
   80 ANG    = ANG+TWOPI
      GO TO 50
   90 ATAN3 = ANG
      RETURN
      END
```

```
*DECK BARC
      SUBROUTINE BARC(I)
*BARC--         BOUNDARY INTERVAL CURVALINEAR DIST              *BARC*

C     INPUT-
C      BDY    = BOUNDARY TABLE OF Z,R,ANG
C      I      = INDEX OF COOR-Z RELATIVE TO BDY-TABLE ORIGIN

C     OUTPUT-
C      DR     = DELTA-R = R(IV+1)-R(IV)
C      DZ     = DELTA-Z = Z(IV+1)-Z(IV)
C      DX     = CHORD CONNECTING THE POINTS OF THE INTERVAL
C      YPA    = ANGLE RELATIVE TO THE CHORD, POINT-IV
C      YPB    = ANGLE RELATIVE TO THE CHORD, POINT-IV+1
C      SINTVL= CURVALINEAR DISTANCE BETWEEN POINTS IV,IV+1
C      (ALSO-YPASQ,YPBSQ,YPAB)

C     BOUNDARY TABLE
C      INDEX- LB=LBDO,LBDE
C      LBNEXT= INCREMENT TO NEXT BOUNDARY
C      LBZ1  = INCREMENT TO THE FIRST BOUNDARY POINT (=0 BEFORE COALLATIO
C      CHNAME= CHANNEL WITH WHICH THE BOUNDARY DATA IS ASSOCIATED
C      UP    = T OR F FOR UPPER OR LOWER BOUNDARY
C      LEDEX = RELATIVE INDEX OF L.E. POINT WHEN LOWER AND UPPER SURFACE
C              CONTOURS ARE CONNECTED
C      BDNAME,LBA,LBB=NAME AND INDEX LIMITS OF SPECIFIC BOUNDARY
C                    DATA WHEN BOUNDARIES ARE COALLATED
       COMMON /CHDATA/ BDT(1),LBNEXT(1),LBZ1(1),
     1                 CHNAME(1),UP(1),LEDEX(1),
     2                 ZBT(1),RBT(1),ANGBT(42)
        LOGICAL        UP
        INTEGER BDT,CHNAME,BDNAME
        DIMENSION      BDNAME(1),LBA(1),LBB(1)
        EQUIVALENCE    (BDNAME,ZBT), (LBA,RBT), (LBB,ANGBT)
       COMMON /CBEAM2/ DR,DZ,YPA,YPB,F,G, DX,YQDX,ZM,RM,ANGM,CURVM,S1M,
     1                 RZONLY, ANGCHD,SINTVL, YPASQ,YPAB,YPBSQ
        LOGICAL        RZONLY

       DZ     = ZBT(I+3)-ZBT(I)
       DR     = RBT(I+3)-RBT(I)
       DX     = SQRT(DZ*DZ+DR*DR)
       IF(DX.EQ.0.) GO TO 90
       ANGCHD= ATAN3(DR,DZ,ANGBT(I))
       YPA    = ANGBT(I)-ANGCHD
       YPB    = ANGBT(I+3)-ANGCHD
       YPASQ = YPA*YPA
       YPAB  = YPA*YPB
       YPBSQ = YPB*YPB
   90  SINTVL= DX*(1. + (YPASQ-.5*YPAB+YPBSQ)/15.)

       RETURN
       END
```

```
*DECK BARCS
      FUNCTION BARCS(NAME,IV1,IV2)
*BARCS*           ACR DISTANCE BETWEEN BOUNDARY PTS                 *BARCS*

C     INPUT-
C      NAME   = BOUNDARY NAME
C      IV1,IV2=INDEX OF POINTS IN THE GIVEN BOUNDARY

C     BOUNDARY TABLE
C      INDEX- LB=LBDO,LBDE
C      LBNEXT= INCREMENT TO NEXT BOUNDARY
C      LBZ1   = INCREMENT TO THE FIRST BOUNDARY POINT (=0 BEFORE COALLATIO
C      CHNAME= CHANNEL WITH WHICH THE BOUNDARY DATA IS ASSOCIATED
C      UP     = T OR F FOR UPPER OR LOWER BOUNDARY
C      LEDEX = RELATIVE INDEX OF L.E. POINT WHEN LOWER AND UPPER SURFACE
C              CONTOURS ARE CONNECTED
C      BDNAME,LBA,LBB=NAME AND INDEX LIMITS OF SPECIFIC BOUNDARY
C                      DATA WHEN BOUNDARIES ARE COALLATED
       COMMON /CHDATA/ BDT(1),LBNEXT(1),LBZ1(1),
     1                 CHNAME(1),UP(1),LEDEX(1),
     2                 ZBT(1),RBT(1),ANGBT(42)
       LOGICAL         UP
       INTEGER BDT,CHNAME,BDNAME
       DIMENSION       BDNAME(1),LBA(1),LBB(1)
       EQUIVALENCE     (BDNAME,ZBT), (LBA,RBT), (LBB,ANGBT)
C
       COMMON /CBEAM2/ DR,DZ,YPA,YPB,F,G, DX,YQDX,ZM,RM,ANGM,CURVM,S1M,
     1                 RZONLY, ANGCHD,SINTVL, YPASQ,YPAB,YPBSQ
       LOGICAL         RZONLY
C      INDEX- M=MO,MM
       COMMON /CZ     / Z(300)
       COMMON /CR     / R(300)
       COMMON /CS2    / S2(300)
       COMMON /CS1    / S1(300)
       COMMON /CPHI1  / PHI1(300)
       COMMON /CM     / JMS(300)
       COMMON /CCURV  / CURV(300)
       COMMON /CB     / B(300)
       COMMON /CIDEX  / M,J,MU,MD,ISTAG

C     INDEX IN /BDYTAB/
       LB     = LBF(NAME)

C     SUM THE ARC DISTANCES FOR INTERVALS IV1 TO (IV2-1)
       I      = LB+LBZ1(LB)+3*(IV1-1)
       IF(ISTAG.EQ.1) I=I+3
       ISTOP = I+3*(IV2-IV1)
       S      = 0.
   75 IF(I-ISTOP)80,90,90
   80 CALL BARC(I)
       S      = S+SINTVL
       I      = I+3
       GO TO 75
   90 BARCS = S

       RETURN
       END
```

```
*DECK BEAM
      SUBROUTINE BEAM(X,Y,ANG,N)
*BEAM--          ROTATED CUBICS SIMULATING A BEAM              *BEAM*
C                FIT TO COORDINATE POINTS

      DIMENSION X(100),Y(100),ANG(100)

C     INPUT-
C      X,Y    = COORDINATES OF POINTS
C      ANG    = ESTIMATED ANGLE AT THE GIVEN POINTS, RADIANS  (MA=1)
C      ANG(1)= ESTIMATED ANGLE AT THE FIRST POINT (MA=0)
C      N      = NUMBER OF POINTS
C      MA     = 0 IF THE VALUES OF ANGLES ARE NOT ESTIMATED,
C             = 1 IF ESTIMATED ANGLES ARE GIVEN
C      MB     = NO OF ITERATIONS
C      KD     = STORAGE INCREMENT OF  X,Y,ANG
C      KORDER= 0 IF ERROR1 IS TO BE CALLED WHEN PTS ARE OUT OF ORDER
C             = -1 TO SKIP THE POINT ORDER CHECK
C             = .GE.1    IF RETURN IS TO BE MADE FOR CORRECTIVE ACTION
C      (IF NOT INPUT MA=0, MB=1, KD=1, AND KORDER=0)
C      SUBROUTINE BEND MUST BE PROVIDED TO CALCULATE THE FOLLOWING COEFFI
C                A(2,1),A(3,1),B(1), A(1,N),A(2,N),B(N)

C     OUTPUT-
C      ANG    = CALCULATED VALUE OF THE CURVE ANGLE, RADIANS
C      B      = SLOPE IN ROTATED COORDINATES, LEFT END OF SEGMENT
C      YPB    = SLOPE IN ROTATED COORDINATES, RIGHT END OF SEGMENT
C      ACHD   = ANGLE (RELATIVE TO HORIZONTAL) OF THE LINE SEGMENTS, RADIA
C      CHD    = LENGTHS OF THE LINE SEGMENTS BETWEEN THE INPUT POINTS, CHO
C      KORDER= INDEX OF 2ND OF ADJACENT OUT-OF-ORDER PTS, NOT=0 ON ENTRY

C     NOTE-COMMON /ERASE/ MUST BE 8*N IN LENGTH.  ITS LENGTH MAY BE CHANG
C      BY A SUSE CARD WITHOUT PROGRM RECOMPILATION.

C     ORDER OF STORAGE IN COMMON /ERASE/ IS - A(1,3),A(1,1),A(1,2),B(1),
C       YPB(1),DA(1),ACHD(1),CHD(1), A(2,1),A(2,2),A(2,3),B(2),YPB(2),DA(

      COMMON /CATAN3/ DANG
      COMMON /CBEAM / MA,MB,KD,KORDER
      COMMON /CPI   / PI,PIDUM(5)
      COMMON /ERASE / A(3),B(1),YPB(1),DA(1),ACHD(1),CHD(793)
       DIMENSION       YPA(100)
       EQUIVALENCE     (YPA,B)
      DATA KNAME/4HBEAM/

      IF(N.LE.1) CALL ERRORK(KNAME)
      M      = MA
      N8     = 8*N-7

C     CALCULATE THE CHORDS CONNECTING THE GIVEN POINTS
C       AND CALC THE TURNING ANGLES BETWEEN SUCCESSIVE CHORDS
      K      = 1
      I      = 1
      IM8    = 1
      ACHD(1)=ANG(1)
  100 KP     = K+KD
      SX     = X(KP)-X(K)
      SY     = Y(KP)-Y(K)
      B(I)   = ANG(K)
      CHD(I)= SQRT(SX*SX+SY*SY)
      ACHD(I)=ATAN3(SY,SX,ACHD(IM8))
      DA(I) = DANG
```

```
      IF(I.GT.9 .AND. (ABS(DA(I))+ABS(DA(IM8))).GT.PI .AND.
     * KORDER.NE.(-1)) GO TO 800
  130 IM8    = I
      I      = I+8
      K      = K+KD
      IF(I-N8) 100,140,140
  140 ACHD(I)=ACHD(I-8)
      DA(I) = 0.
      B(I)   = ANG(K)

C     SLOPES IN THE ROTATED COORDINATE SYSTEM
C      FROM THE ESTIMATED INPUT ANGLES
      I      = 1
      IF(M) 160,180,160
  160 YPA(I)= TAN(B(I)-ACHD(I))
      YPB(I)= TAN(B(I+8)-ACHD(I))
      I      = I+8
      IF(I-N8) 160,200,200

C      SLOPES EQUAL TO A FRACTION OF THE LINE SEGMENT TURNING
  180 YPA(1)= -.2*DA(9)
      I      = 9
  185 YPB(I-8)=.4*DA(I)
      YPA(I)= -YPB(I-8)
      I      = I+8
      IF(I-N8) 185,190,190
  190 YPB(I-8)=.2*DA(I-8)

C     END EQUATIONS
  200 CALL BEND(N)

C     MATCHING  ANGLE  AND  CURVATURE  EQUATIONS
      IF(N-2) 250,800,250
  250 I      = 9
      GO TO 260
  255 A(I)   = CHD(I)*(1.+1.5*YPA(I)*YPA(I))
      A(I+2)= CHD(I-8)*(1.+1.5*YPB(I-8)*YPB(I-8))
      A(I+1)= 2.*(A(I)+A(I+2))
      B(I)   = -2.*A(I   )*DA(I) - A(I+2)*DA(I+8)
      I      = I+8
  260 IF(I-N8) 255,300,300

C     ROUTINE TDSEQ  -  TRIDIAGONAL SIMULTANEOUS EQUATIONS
C       SOLUTION TO  AX=B,  ON RETURN SOLUTION VECTOR  X  IS STORED IN  B
  300 A(3)   = A(3)/A(2)
      B(1)   = B(1)/A(2)
      I      = 9
C          SPECIAL LOGIC FOR A(1,3)
           A(1)   = A(1)/A(2)
           A(10)  = A(10)-A(9)*A(3)
           A(11)  = (A(11)-A(9)*A(1))/A(10)
           GO TO 312
  310 A(I+1)= A(I+1)-A(I)*A(I-6)
      A(I+2)= A(I+2)/A(I+1)
  312 B(I)   = (B(I)-A(I)*B(I-8)) / A(I+1)
      I      = I+8
      IF(I-N8) 310,320,340
C          SPECIAL LOGIC FOR  A(N,N-2)
  320      A(I)   = A(I)-A(I+2)*A(I-14)
           B(I)   = B(I)-A(I+2)*B(I-16)
           GO TO 310
```

```
C     BACK SUBSTITUTION
  340 I        = N8
  350 I        = I-8
      IF(I-1) 400,355,360
C          SPECIAL LOGIC FOR A(1,I)
  355      B(1)   = B(1)-A(1)*B(17)
  360 B(I)   = B(I)-A(I+2)*B(I+8)
      GO TO 350

C     REEVALUATE  YPB
  400 I        = 9
  405 YPB(I-8)= B(I)+DA(I)
      I        = I+8
      IF(I-N8) 405,405,450

C     RETURN FOR ANOTHER ITERATION
  450 M        = M+1
      IF(M-MB) 200,200,500

C     ANGLES
  500 I        = 1
      K        = 1
  505 ANG(K)= ACHD(I)+ATAN(B(I))
      I        = I+8
      K        = K+KD
      IF(I-N8)505,505,530
  530 KORDER= 0
      GO TO 900

C      ERROR - OUT OF ORDER POINTS
  800 IF(KORDER.EQ.0) CALL ERRORK(KNAME)
      KORDER= K

  900 RETURN
      END
```

```
*DECK CBEAM
      BLOCK DATA BEAMBK
*CBEAM*          DATA FOR /CBEAM /                                   *CBEAM*
      COMMON /CBEAM / MA,MB,KD,KORDER
      DATA MA,MB,KD,KORDER/0,1,1,0/
      END
```

```
*DECK BEND
      SUBROUTINE BEND(NN)
*BEND--          END CONDITIONS FOR THE BEAM FIT                    *BEND*

C     ON ENTRY -
C       N       = NUMBER OF POINTS
C        ALSO DEFINED ON ENTRY - IN COMMON/CBEND/ -
C       NBC(L)= BOUNDARY CONDITION INDICATOR FOR LEFT(L=1) AND RIGHT(L=2)
C              = 0, 1, OR 2
C       ANGE(L)=ANGLE IN DEGREES  IF  NBC(L)=1
C       CURVE(L)=CURVATURE  IF NBC(L)=2
C       FEND(L)= RATIO OF SHEAR OF THE END TO NEXT TO END INTERVAL, NBC(L)

C     ON RETURN-
C       COEFFICIENTS - A(2),A(3),B(1)  AND  A(N8),A(N8+1),B(N8)

      COMMON /CBEND / NBC(2),ANGE(2),CURVE(2),FEND(2)
      COMMON /CPI    / PI,TWOPI,PIO2,PIO4,TODEG,TORAD
      COMMON /ERASE / A(3),B(1),YPB(1),DA(1),ACHD(1),CHD(793)

C     INITIALIZE
      N       = NN
C     N8      = INDEX FOR RIGHT END POINT
      N8      = 8*N-7
      A(1)    = 0.
      A(2)    = 1.
      A(3)    = 0.
      A(N8)   = 0.
      A(N8+1)=1.
      A(N8+2)=0.

C     A STRAIGHT LINE IS USED FOR N=2 IF  NBC(1)=NBC(2)=0
      NBCS = NBC(1)+NBC(2)
      IF(N.GT.2 .OR. NBCS.GT.0) GO TO 80
      B(1)    = 0.
      B(9)    = 0.
      B(2)    = 0.
      GO TO 900

C     CHECK IF PARABOLA (F=0) SHOULD BE USED
   80 IF(N.EQ.3 .AND. NBCS.EQ.0) GO TO 90
      F1      = FEND(1)
      F2      = FEND(2)
      GO TO 110
   90 F1      = 0.
      F2      = 0.

C     NBC=01,  Y  AND  ANGLE  SPECIFIED
C       LEFT END
  110 IF(NBC(1).NE.01) GO TO 120
      B(1)    = TAN(TORAD*ANGE(1)*ACHD(1))
C       RIGHT END
  120 IF(NBC(2).NE.01) GO TO 210
      B(N8) = TAN(TORAD*ANGE(2)*ACHD(N8))

C     NBC=02,  Y  AND  CURVATURE  SPECIFIED
C       LEFT END
  210 IF(NBC(1).NE.02) GO TO 220
      A(2)    = 4.
      A(3)    = 2.
      B(1)    = -2.*DA(9)*CHD(1)*CURVE(1)*(1.+1.5*B(1)*B(1))
C       RIGHT END
```

```
  220 IF(NBC(2).NE.0) GO TO 310
      A(N8) = 2.
      A(N8+1)=4.
      B(N8) = -CHD(N8-8)*CURVE(2)*(1.+1.5*YPB(N8-8)*YPB(N8-8))

C     NBC=0,   YPPP = F * YPPP(OF ADJACENT INTERVAL)
C       LEFT END
  310 IF(NBC(1).NE.0) GO TO 320
      IF(N.EQ.2) GO TO 315
      DX1SQ = CHD(1)*CHD(1)
      DX2SQ = CHD(9)*CHD(9)
      A(2)  = DX2SQ
      A(1)  = -F1*DX1SQ
      A(3)  = A(2)+A(1)
      B(1)  = F1*DA(17)*DX1SQ - DA(9)*DX2SQ
      GO TO 320
  315 A(3)  = 1.
      B(1)  = 0.
C       RIGHT END
  320 IF(NBC(2).NE.0) GO TO 900
      IF(N.EQ.2) GO TO 325
      DXNSQ = CHD(N8-8)*CHD(N8-8)
      DXMSQ = CHD(N8-16)*CHD(N8-16)
      A(N8+2)=-F2*DXNSQ
      A(N8+1)=DXMSQ
      A(N8) = A(N8+1)+A(N8+2)
      B(N8) = F2*DA(N8-8)*DXNSQ
      GO TO 900
  325 A(N8) = 1.
      B(N8) = 0.

  900 RETURN
      END
```

```
*DECK CBEND
      BLOCK DATA BENDBK
*CBEND*          DATA FOR /CBEND /                                    *CBEND*
      COMMON /CBEND / NBC(2),ANGE(2),CURVE(2),FEND(2)
      DATA NBC,ANGE,CURVE,FEND/2*0,6*0./
      END
```

```
*DECK BFI
      SUBROUTINE BFI
*BFI--*          BEAM FIT INTERPOLATION                         *BFI*

C     INPUT-
C      DR     = R(I+1)-R(I)
C      DZ     = Z(I+1)-Z(I)
C      YPA    = ANGLE RELATIVE TO THE CHORD, POINT-I
C      YPB    = ANGLE RELATIVE TO THE CHORD, POINT-I+1
C      F      = X/DX
C      G      = (DX-X)/DX
C      RZONLY= T  IF  YQDX, RM AND ZM  ONLY ARE TO BE COMPUTED
C

C     OUTPUT DATA AT THE INTERMEDIATE POINT WITHIN THE INTERVAL
C      YQDX   = Y/DX, DISTANCE NORMAL TO THE CHORD
C      ZM     = Z-Z(I)
C      RM     = R-R(I)
C      DX     = LENGTH OF THE CHORD
C      ANGM   = ANG-ANGCHD
C      CURVM  = CURVATURE
C      S1M    = CURVALINEAR DISTANCE FROM POINT-I

C     NOTES-
C      CHORD = LINE BETWEEN POINTS  I  AND  I+1

      COMMON /CBEAM2/ DR,DZ,YPA,YPB,F,G, DX,YQDX,ZM,RM,ANGM,CURVM,S1M,
     1                RZONLY
       LOGICAL        RZONLY

      DOUBLE PRECISION C1,C2,C3,C4,C5

      YQDX  = F*G*(G*YPA-F*YPB)
      RM    = YQDX*DZ+F*DR
      ZM    = F*DZ-YQDX*DR
      IF(RZONLY) GO TO 990
      DX    = SQRT(DR*DR+DZ*DZ)
      ANGM  = YPA*(3.*G-2.)*G + YPB*(3.*F-2.)*F
      CURVM = (YPA*(6.*G-2.)+YPB*(-6.*F+2.))/(DX*(1.+1.5*ANGM*ANGM))
      YPASQ = YPA*YPA
      YPAB  = YPA*YPB
      YPBSQ = YPB*YPB
      C1    = 1.+.5*YPASQ
      C2    = -2.*YPASQ-YPAB
      C3    = (11.*(YPASQ+YPAB) + YPBSQ+YPBSQ)/3.
      C4    = -3.*YPASQ - 4.5*YPAB - 1.5*YPBSQ
      C5    = 9.*(YPASQ+YPAB+YPAB+YPBSQ)/10.
      S1M   = DX*(F*(C1+F*(C2+F*(C3+F*(C4+F*C5)))))
  990 RETURN
      END
```

```
*DECK CBFI
      BLOCK DATA BFIBLK
*CBFI*-          BLOCK DATA FOR BFI                              *CBFI*
      COMMON /CBEAM2/ DR,DZ,YPA,YPB,F,G, DX,YQDX,ZM,RM,ANGM,CURVM,S1M,
     1                RZONLY
       LOGICAL        RZONLY
      DATA RZONLY/.FALSE./
      END
```

```
*DECK CRTIME
      SUBROUTINE CRTIME(TIME)
      COMMON /ERASE2/  IA(200),DUM(1336)
      RETURN
      END
```

```
*DECK FHEAD
      SUBROUTINE FHEAD(LA1)
CFHEAD---- CDC VERSION
      COMMON /ADAM01/ NAME(6),ADDRES(6),TITLE(6),IDENT(6)
      COMMON /CLINES/ LINES,OMITFK,PTITLE(6)
      COMMON /LINMAX/ LMAX

      LA     = LA1

C     ADJUST LINE COUNT
    5 LINTOT= LINES+LA
      IF( LINTOT.GT.LMAX ) GO TO 8
      LINES = LINTOT
    6 RETURN
C     RESTORE AND PRINT IDENTIFICATION IF LINE COUNT.GT.LMAX
    8 WRITE (6,810) TITLE,PTITLE,IDENT
      LINES = LA+3
      GO TO 6
  810 FORMAT(1H1,6A10,33X,6A6/1X,6A10)
      END
```

```
*DECK GETIX
          IDENT   GETIX
          ENTRY   GETIX,SAVIX
*       SUBROUTINE GETIX
*
*       COMMON /CM    / JMS(300)
*       COMMON /CIDEX / M,J,MU,MD,ISTAG
*       INPUT=
*        JMS    = ARRAY CONTAINING PACKED INDICES J,MU,MD,ISTAG
*        M      = INDEX OF  -JMS- ARRAY
*       OUTPUT-
*        J      = STREAMLINE NUMBER
*        MU     = M- UPSTREAM
*        MD     = M- DOWNSTREAM
*        ISTAG  = INDICATOR FOR STAGNATION POINT. ETC.
*
GETIX     BSSZ    1
          SA1     M               CONTENTS OF M IN X1
          SA2     X1+JMS-1        JMS(M) IN X2
          SB3     0               INITIALIZE
          SB4     3
LOOPG     SA3     MASK1+B3        LOAD MASK
          BX6     X2*X3           AND TO MASK
          SA1     SHIFT+B3        SHIFT BITS IN X1
          SB5     X1              MOVE TO B5
          AX6     X6,B5           SHIFT
          SA6     J+B3            STORE
          SB3     B3+1
          LE      B3,B4,LOOPG
          JP      GETIX           TRA FOR RETURN
*
*       SUBROUTINE SAVIX
*       INPUT=
*        M      = INDEX OF JMS ARRAY
*        J      = STREAMLINE NUMBER
*        MU     = M- UPSTREAM
*        MD     = M- DOWNSTREAM
*        ISTAG  = INDICATOR FOR STAGNATION POINT. ETC.
*       OUTPUT-
*        JMS(M)= PACKED J,MU,MD,ISTAG
*
SAVIX     BSSZ    1
          MX3     0
          SB3     0               INITIALIZE
          SB4     3
LOOPS     SA2     B3+J            J IN X2
          SA1     SHIFT+B3
          SB5     X1
          LX2     X2,B5           SHIFT LEFT
          BX3     X3+X2           OR TO X3
          SB3     B3+1
          LE      B3,B4,LOOPS
          SA1     M
          BX6     X3              MOVE TO X6
          SA6     X1+JMS-1        STORE JMS(M)
          JP      SAVIX           TRA FOR RETURN
MASK1     DATA    00000000077600000000
          DATA    00000000000177700000
          DATA    00000000000000077774
          DATA    00000000000000000003
SHIFT     DATA    28
          DATA    15
```

```
          DATA   2
          DATA   0
          USE    /CM/
JMS       BSS    300
          USE    /CIDEX/
M         BSS    1
J         BSS    1
MU        BSS    1
MD        BSS    1
ISTAG     BSS    1
*
          END
```

```
*DECK GETRLX
          IDENT   GETRLX
          ENTRY   GETRLX
*
 GETRLX   BSSZ    1
          SB4     25          INITIALIZE REGISTERS
          SB7     -5
 LOOP     SB7     B7+5        INDEX B7
          GE      B7,B4,GETRLX
 LOOP2    SA1     B7+M        CONTENTS OF M IN X1
          SA2     X1+JMS-1    JMS(M) IN X2
          SA3     MASK1       MU-MASK IN X3
          BX6     X2*X3       EXTRACT MU
          SA1     SHIFT
          SB3     X1          SHIFT BITS
          AX6     X6,B3       SHIFT RIGHT
          NZ      X6,UP0      TEST FOR STREAMLINE ORIGIN
          SA4     M           M- TO X4
          BX6     X4          MOVE TO X6
 UP0      SA6     B7+MU       STORE CURRENT MU
          SA3     MASK1+1     MD-MASK IN X3
          BX6     X2*X3       EXTRACT MD
          SA1     SHIFT+1
          SB3     X1          SHIFT BITS
          AX6     X6,B3       SHIFT RIGHT
          NZ      X6,DN0      TEST FOR STREAMLINE TERMINATION
          SA4     M           M- TO X4
          BX6     X4          MOVE TO X6
 DN0      SA6     B7+MD       STORE CURRENT MD
          SA3     MASK1+2     ISTAG-MASK IN X3
          BX6     X2*X3       EXTRACT ISTAG
          SB6     3
          SB3     X6          MOVE LOW ORDER BITS TO B3
          NE      B3,B6,NOTPO TEST FOR PARTIAL ORTHOGONAL
          ZR      B7,NOTPO    BRANCH IF MID-POINT
          SB3     5
          EQ      B3,B7,UPPO
          SB3     15
          EQ      B3,B7,UPPO
          SA4     B7+MD       CURRENT MD IN X4
          BX6     X4          MOVE TO X6
          SA6     B7+M        RESET M TO MOVE RIGHT
          JP      LOOP2
*
 UPPO     SA4     B7+MU       CURRENT MU IN X4
          BX6     X4          MOVE TO X6
          SA6     B7+M        RESET M TO MOVE LEFT
          JP      LOOP2
*
 NOTPO    SB3     15
          GE      B7,B3,LOOP  CONTINUE IF ON EXTREME(M2,M6) POINTS
          NZ      B7,TEST1    CONTINUE CHECK
          SA4     MU          MU IN X4
          BX6     X4          MOVE TO X6
          SA6     M+5         SET UP FOR M3,M5
          SA4     MD
          BX6     X4          MOVE TO X6
          SA6     M+10
          JP      LOOP
*
 TEST1    SB3     5
          NE      B7,B3,TEST2
```

```
         SA4    B7+MU          SET UP M2 POINT
         BX6    X4             MOVE TO X6
         SA6    M$15
         JP     LOOP
TEST2    SA4    B7+MD          SET UP M6 POINT
         BX6    X4             MOVE TO X6
         SA6    M$20
         JP     LOOP
MASK1    DATA   00000000000177770000
         DATA   00000000000000077774
         DATA   00000000000000000003
SHIFT    DATA   15
         DATA   2
         USE    /CM/
JMS      BSS    300
         USE    /CIDEXR/
M        BSS    2
MU       BSS    1
MD       BSS    1
ISTAG    BSS    21
         END
```

```
*DECK JMSPRT
      SUBROUTINE JMSPRT
*JMSPRT          PRINT INDEX ARRAY,  JMS                                *JMSPRT*
      COMMON /IXORIG/ LHO,LHE, LBDO,LBDE, LTO,LTE, LWO,LWE, LFO,LFE,
     *                LO,LESTA,  LDUM(8),
     *                MO,NM, NJ,NFCOLS, MAXNJ,MAXOL,MAXNM,MAXLE,
     *                LEO,LEE, LRO,LRE,LRD
       DIMENSION      LIMITS(24)
       EQUIVALENCE    (LIMITS,LHO)

      COMMON /CIDEX / M,J,MU,MD,ISTAG
      COMMON /CM    / JMS(300)
      COMMON /ERASE / IOUT(800).

C     RESTOR PAGE
      WRITE (6,1000)

      M      = 1
      IS      = 30
   40 I      = 1
      MA     = M
   50 CALL GETIX
      IOUT(I)=J
      IOUT(I+1)=MU
      IOUT(I+2)=MD
      IF(ISTAG .EQ. 0) GO TO 60
      IOUT(IS+1) = M
      IOUT(IS+2) = ISTAG
      IS = IS + 2
   60 I      = I+3
      M      = M+1
      IF(I.LT.30 .AND. M.LE.NM) GO TO 50
      IB     = I-1
      WRITE (6,1002) MA,(IOUT(L),L=1,IB)
      IF(M.LE.NM) GO TO 40
      WRITE (6,1004) (IOUT(I),I=31,IS)
 1000 FORMAT(8H1J-MU-MD)
 1002 FORMAT(1X,I5,30I4)
 1004 FORMAT(/8H M-ISTAG/(6X,20I5))
      RETURN
      END
```

```
*DECK LBF
      FUNCTION LBF(BDYNAM)
*LBF---         BOUNDARY TABLE INDEX FROM BDY NAME             *LBF*

       INTEGER BLANK,BDYNAM
C
C     BOUNDARY TABLE
C      INDEX- LB=LBDO,LBDE
C      LBNEXT= INCREMENT TO NEXT BOUNDARY
C      LBZ1  = INCREMENT TO THE FIRST BOUNDARY POINT (=0 BEFORE COALLATIO
C      CHNAME= CHANNEL WITH WHICH THE BOUNDARY DATA IS ASSOCIATED
C      UP    = T OR F FOR UPPER OR LOWER BOUNDARY
C      LEDEX = RELATIVE INDEX OF L.E. POINT WHEN LOWER AND UPPER SURFACE
C              CONTOURS ARE CONNECTED
C      BDNAME,LBA,LBB=NAME AND INDEX LIMITS OF SPECIFIC BOUNDARY
C                    DATA WHEN BOUNDARIES ARE COALLATED
      COMMON /CHDATA/ BDT(1),LBNEXT(1),LBZ1(1),
     1                CHNAME(1),UP(1),LEDEX(1),
     2                ZBT(1),RBT(1),ANGBT(42)
       LOGICAL        UP
       INTEGER BDT,CHNAME,BDNAME
       DIMENSION      BDNAME(1),LBA(1),LBB(1)
       EQUIVALENCE    (BDNAME,ZBT), (LBA,RBT), (LBB,ANGBT)
C
      COMMON /IXORIG/ LHO,LHE, LBDO,LBDE, LTO,LTE, LWO,LWE, LFO,LFE,
     *                LO,LESTA,  LDUM(8),
     *                MO,NM, NJ,NFCOLS, MAXNJ,MAXOL,MAXNM,MAXLE,
     *                LEO,LEE, LRO,LRE,LRD
       DIMENSION      LIMITS(24)
       EQUIVALENCE    (LIMITS,LHO)
      COMMON /CBITS / BITS,BLANK

C     SEARCH FOR MATCHING BOUNDARY NAME
      LB     = LBDO
   60 IF(BDT(LB).EQ.BLANK .OR. LB.GE.LBDE) GO TO 80
      IF(BDT(LB).EQ.BDYNAM) GO TO 70
      LB     = LB+LBNEXT(LB)
      GO TO 60
   70 LBF    = LB
      RETURN
   80 LBF    = 0
      RETURN
      END
```

```
*DECK LFIT1
      SUBROUTINE LFIT1(X,Y,NPTS, XC,YC,NXC)                          *LFI1*
*LFIT1            LINEAR FIT INTERPOLATION
      DIMENSION              X(10),Y(10), XC(10),YC(10)

C     INPUT-
C      X,Y    = LIST OF COORDINATES DESCRIBING THE INPUT FUNCTION
C      NPTS   = NUMBER OF X,Y POINTS
C      XC     = LIST OF X-S AT WHICH INTERPOLATION IS TO BE PERFORMED
C      NXC    = NUMBER OF XC-VALUES

C     OUTPUT-
C      YC     = LIST OF VALUES INTERPOLATED AT XC(IC),IC=1,NXC

C     NOTES-
C      IF  XC  IS OUTSIDE OF THE RANGE OF  X,  THE END VALUE OF  Y  IS SU
C          FOR YC.
C      X  MUST BE LISTED FROM SMALLEST TO LARGEST.
C      DOUBLE  X-POINTS ARE ALLOWED FOR A FUNCTION DISCONTINUITY.

      COMMON /CLFIT1/ LFOUT
       LOGICAL          LFOUT
      N       = NPTS
      I       = 1

C     BEGIN INTERPOLATION LOOP FOR  XC(IC),IC=1,NXC
      IC      = 1
   60 XCIC    = XC(IC)
      IF(N.GT.1) GO TO 100
      YC(IC)=Y(1)
      GO TO 190

  100 XG      = X(I+1)-XCIC
      IF(XG) 114,114,102
  102 XF      = XCIC-X(I)
      IF(XF) 110,120,120

C       F.LT.0. (F IS THE FRACTIONAL POSITION IN THE INTERVAL)
  110 I       = I-1
      IF(I) 100,111,100
  111 I       = 1
      YC(IC)= Y(1)
      IF (LFOUT) YC(IC)=0.
      GO TO 190

C       F.GE.1.
  114 I       = I+1
      IF(I-N) 100,115,100
  115 I       = N-1
      YC(IC)= Y(N)
      GO TO 190

C     INTERPOLATE
  120 YC(IC)= (Y(I)*XG+Y(I+1)*XF)/(XG+XF)

C     INDEX TO NEXT  XC(IC)
  190 IC      = IC+1
      IF(IC.LE.NXC) GO TO 60

      RETURN
      END
```

```
*DECK LOC2
      FUNCTION LOC2(IA,IB)
CLOC2--- CDC VERSION
C     IABS( ADDRESS(IB)-ADDRESS(IA) )
      LOC2  = IABS( LOCF(IB)-LOCF(IA) )
      RETURN
      END
```

```
*DECK LSPFIT
      SUBROUTINE LSPFIT(X,Y,NPTS, XC,YC,NXC,ND)
*LSPFIT          INTEGRATE OR INTERPOLATE                         *LSPFIT*
C      INTEGRATE OR INTERPOLATE USING A PARABOLA WHICH PASSED THROUGH THE
C      AND (I+1) POINTS BUT MISSES THE (I-1) AND (I+2) POINTS (IF THEY DO
C      EXIST) SUCH THAT THE SQUARE OF THE DEVIATION IS A MINIMUM.  NOTE
C      THAT  I  IS GENERALLY SELECTED SUCH THAT
C                X(I).LE.XC.LT.X(I+1)
C      THE EQUATION FOR THE PARABOLA IS
C                Y=Y(I) + B*(X-X(I)) + C*(X-X(I))**2

      DIMENSION X(10),Y(10), XC(10),YC(10)
C       NOTE. THE DIMENSION *10* DOES NOT NEED TO AGREE WITH THE CALLING

C     INPUT-
C      X, Y     PTS. ON CURVE
C      NPTS     NO. OF X
C      XC       LIST OF X AT WHICH CALC TO BE DONE
C      YC(1)    INTEGRATION CONSTANT IF  ND=-1
C      NXC      NO. OF XC
C      ND       =0 TO GET COORD,  =1 TO GET 1ST DERIVATIVE,
C               =-1 FOR INTEGRATION
C      LEND   = LINEAR FIT IN END INTERVAL, T OR F

C     OUTPUT
C      YC       COORDINATE OR DERIVATIVE AT XC    OR
C               YC(IC)= INTEGRAL(Y*DX) FROM XC(1) TO XC(IC) WHERE IC=2,NXC

C     NOTES-
C      *X* MAY BE IN EITHER ASCENDING OR DESCENDING ORDER.
C      FOR INTEGRATION *XC* MUST BE IN THE SAME ORDER AS *X*.  FOR INTERP
C         NO SPECIAL ORDER IS REQUIRED.

      COMMON /CLSPF / I,LEND
       LOGICAL          LEND

      LOGICAL          WITHIN
      DATA KNAME/6HLSPFIT/

      N      = NPTS-1
      IF(ND.EQ.(-1)) I=1
      ISAVE  = 0
      SGN    = SIGN(1.,X(N+1)-X(1))

C     BEGIN INTERPOLATION LOOP FOR XC(IC)  IC=1,NXC
       IC    = 1

C     LOCATE APPROPRIATE INTERVAL
  100 I      = MAX0(1,MIN0(I,N))
      WITHIN= .FALSE.
      NCOUNT= N
  102 IF(NCOUNT) 119,103,103
  103 NCOUNT= NCOUNT-1

      XI     = X(I)
      XD     = XC(IC)-XI
      IF(N) 104,120,104
  104 IF(SGN*XD) 105,107,110

C       F.LT.0. (F IS THE FRACTIONAL POSITION IN THE INTERVAL)
  105 IF(I.EQ.1)     GO TO 120
      IF(ND.EQ.(-1)) GO TO 119
```

```
      I      = I-1
      GO TO 102

C       F.EQ.0
  107 IF(X(I+1).NE.XI) GO TO 120
      IF(I.GE.N) GO TO 105
      GO TO 116

C       F.GT.0.
  110 IF(SGN*(XC(IC)-X(I+1))) 120,112,114

C       F.EQ.1.0,  CHECK FOR INTEGRATION AND DOUBLE POINT BEFORE INCREMEN
  112 IF((ND.EQ.(-1)) .OR. (I.NE.N .AND. X(I+1).EQ.X(I+2))) GO TO 120

C       F.GT.1.0
  114 IF(I.EQ.N) GO TO 120
      IF(ND.EQ.(-1)) GO TO 122
  116 I      = I+1
      GO TO 102

  119 CALL ERRORK(KNAME)

C     PRELIMINARY CALCULATIONS FOR INTERPOLATION OR INTEGRATION
  120 WITHIN=.TRUE.
  122 IF(I-ISAVE) 124,129,124
  124 ISAVE  = I
      YI     = Y(I)
      X3     = X(I+1)-XI
      Y3     = Y(I+1)-YI
      C      = 0.
      TOP    = 0.
      BOT    = 0.
      IF(LEND .AND. (I.EQ.1 .OR. I.EQ.N)) GO TO 128
      IF(I.LE.1) GO TO 127
      X1     = X(I-1)-XI
      X13    = X(I-1)-X(I+1)
      TOP    = X1*(Y3*X1-(Y(I-1)-YI)*X3)*X13
      BOT    = X1*X1*X13*X13*X3
  127 IF(I.GE.N .OR. (XD.EQ.0..AND.BOT.NE.0.)) GO TO 128
      X4     = X(I+2)-XI
      X43    = X(I+2)-X(I+1)
      Y4     = Y(I+2)-YI
      TOP    = TOP + X4*(Y3*X4-Y4*X3)*X43
      BOT    = BOT + X4*X4*X43*X43*X3
  128 IF(BOT.NE.0.) C = -TOP/BOT
      B      = 0.
      IF(N.GT.0 .AND. X3.NE.0.) B = (Y(I+1)-YI)/X3 - C*X3
  129 IF(ND) 130,140,141

C     ND=-1, INTEGRATE
  130 IF(.NOT.WITHIN) XD=X3
      S1     = (YI + (B/2. + C/3.*XD)*XD)*XD
      IF(WITHIN) GO TO 135
C     @I@ IS BEING INCREMENTED TO FIND APPROPRIATE INTERVAL.  HENCE,
C       CUMULATE THE INTEGRAL OF THE ITH INTERVAL.
      SA     = SA + S1
      GO TO 116
C     APPROPRIATE INTERVAL FOUND.    X(I)=XC(IC)-X(I+1)
  135 IF(IC.EQ.1) SA=YC(IC)-S1
      IF(IC.NE.1) YC(IC)=SA+S1
      GO TO 150
```

```
C     ND=0,  INTERPOLATE FOR COORDINATES
  140 YC(IC)= YI + (B + C*XD)*XD
      GO TO 150

C     ND=1,  FIRST DERIVATIVE
  141 YC(IC)= B + 2.*C*XD
      GO TO 150

  150 IC     = IC+1
      IF(NXC-IC) 900,160,160
  160 IF(ND.NE.(-1).AND.XC(IC).EQ.XC(IC-1)) I=I+1
      GO TO 100

  900 RETURN
      END
```

```
*DECK LSUM
      SUBROUTINE LSUM(X,Y,N, S)                                          *LSUM*
*LSUM*-          CUMULATIVE TAPEZOIDAL INTEGRATION
      DIMENSION X(9),Y(9),S(9)
      DO 90 I=2,N
   90 S(I)  =  .5*(Y(I)+Y(I-1))*(X(I)-X(I-1)) +S(I-1)
      RETURN
      END
```

```
*DECK MBEGIN
      FUNCTION MBEGIN(J2)
*MBEGIN          FIND FIRST FIELD POINT                                    *MBEGIN*
C                FOR A GIVEN STREAMLINE

C     INPUT
C      J2    = STREAMLINE INDEX
C     OUTPUT-
C      MBEGIN= FIELD INDEX OF FIRST POINT ON THE SL

       COMMON /IXORIG/ LHO,LHE, LBDO,LBDE, LTO,LTE, LWO,LWE, LFO,LFE,
     *                 LO,LESTA,  LDUM(8),
     *                 MO,NM, NJ,NFCOLS, MAXNJ,MAXOL,MAXNM,MAXLE,
     *                 LEO,LEE, LRO,LRB,LRD
        DIMENSION      LIMITS(24)
        EQUIVALENCE    (LIMITS,LHO)

       COMMON /CIDEX / M,J,MU,MD,ISTAG
       DATA KNAME/6HMBEGIN/

C     SEARCH FOR FIRST POINT ON STREAMLINE  J
  101 M       = 1
  105 CALL GETIX
      IF (J.EQ.J2 .AND. MU.EQ.0) GO TO 115
  110 IF(M.EQ.NM) CALL ERRORK(KNAME)
  112 M       = M+1
      GO TO 105

  115 MBEGIN= M
      RETURN
      END
```

```
*DECK MNMX
      SUBROUTINE MINMAX(A,I1,I2,AMIN,IMIN,AMAX,IMAX)
C           MINIMUM-MAXIMUM SEARCH ROUTINE
C
C           THIS PROCEDURE DETERMINES THE MINIMUM AND MAXIMUM
C           FLOATING POINT VALUES AND THEIR RESPECTIVE
C           POSITIONS IN A SPECIFIED AREA OF AN ARRAY.
C
      DIMENSION A(1)
      AMIN=A(I1)
      IMIN=I1
      AMAX=A(I1)
      IMAX=I1
      DO 5 I=I1,I2
      IF(A(I).GE.AMIN) GO TO 10
      AMIN=A(I)
      IMIN=I
      GO TO 5
   10 IF(A(I).LE.AMAX) GO TO 5
      AMAX=A(I)
      IMAX=I
    5 CONTINUE
      RETURN
      END
```

```
*DECK MOVE
      SUBROUTINE MOVE(NR,X1,Y1,N1,ND1,X2,Y2,N2,ND2,X3,Y3,N3,ND3)
CMOVE ==== FORTRAN SIMULATION OF MOVE (CDC)
      DIMENSION X1(1),Y1(1),X2(1),Y2(1),X3(1),Y3(1)
      DO 100 L=1,NR
      GO TO (5,10,15) , L
    5 N       = IABS(N1)
      ND      = ND1
      IF( N1.LT.0 ) ND=-1
      NS      = N1
      GO TO 40
   10 N       = IABS(N2)
      ND      = ND2
      IF( N2.LT.0 ) ND=-1
      NS      = N2
      GO TO 40
   15 N       = IABS(N3)
      ND      = ND3
      IF( N3.LT.0 ) ND=-1
      NS      = N3
   40 K       = 1
      IF(NS)401,100,41
  401 K       = N
   41 IF( (K.LE.0) .OR. (K.GT.N) .OR. NS.EQ.0 ) GO TO 100
      GO TO (45,50,55) , L
   45 Y1(K) = X1(K)
      GO TO 80
   50 Y2(K) = X2(K)
      GO TO 80
   55 Y3(K) = X3(K)
   80 K       = K+ND
      GO TO 41
  100 CONTINUE
      RETURN
      END
```

```
*DECK SETM
      SUBROUTINE SETM(NR,VAL,X1,N1,X2,N2,X3,N3)
      DIMENSION X1(1),X2(1),X3(1)
CSETM ---- FORTRAN SIMULATION OF SETM(CDC)
      DO 200 L=1,NR
      GO TO (105,110,115) , L
  105 NS       = N1
      GO TO 140
  110 NS       = N2
      GO TO 140
  115 NS       = N3
  140 DO 180 K=1,NS
      GO TO (145,150,155) , L
  145 X1(K) = VAL
      GO TO 180
  150 X2(K) = VAL
      GO TO 180
  155 X3(K) = VAL
  180 CONTINUE
  200 CONTINUE
      RETURN
      END
```

```
*DECK FMPYC
      SUBROUTINE FMPYC(NR,C,X1,Y1,N1,X2,Y2,N2,X3,Y3,N3)
      DIMENSION X1(1),Y1(1),X2(1),Y2(1),X3(1),Y3(1)
CFMPYC ---- FORTRAN SIMULATION OF FMPYC (CDC)
      DO 300 L=1,NR
      GO TO (205,210,215) , L
  205 NS     = N1
      GO TO 240
  210 NS     = N2
      GO TO 240
  215 NS     = N3
  240 DO 280 K=1,NS
      GO TO (245,250,255) , L
  245 Y1(K) = C*X1(K)
      GO TO 280
  250 Y2(K) = C*X2(K)
      GO TO 280
  255 Y3(K) = C*X3(K)
  280 CONTINUE
  300 CONTINUE
      RETURN
      END
```

```
*DECK QIREM
      SUBROUTINE QIREM(X,Y, XJP, QV)
*QIREM=      QUADRATIC INTERPOLATION ROOT EVALUATION       *QIREM*
C            FOR FUNCTIONS WITH MAXIMUMS

       DIMENSION QV(8)
      DATA KNAME/6HQIREM /

C     INPUT-
C      X      = ABSCISSA
C      Y      = ORDINATE (OR ERROR)
C      XJP    = X-JUMP TO BE TAKEN BEFORE ROOT/MAX IS SPANNED.  THE SIGN I
C               A POSITIVE ERROR
C      QV     = STORAGE FOR EIGHT ELEMENT QIRE VECTOR
C      QV(1)  = CTR =0. (FIRST ENTRY ONLY)
C      YTOL   = TOLERANCE ON THE ERROR
C      YO     = ORDINATE TO BE OBTAINED (OPTIONAL)
C      DYDX   = ESTIMATE OF SLOPE FOR 2ND GUESS (OPTIONAL)
C      CTRMAX= MAXIMUM NO. OF ITERATIONS (=25 IF NOT SPECIFIED)

C     OUTPUT-
C      X      = NEXT X ESTIMATE
C      QV(1)  = 0. IF  YTOL  HAS BEEN SATISFIED
C      QV(5)  = 0. IF MAX PT HAS BEEN FOUND WITHIN YTOL.
C                     AND ABS(E).GT.YTOL.

C     NOTES-
C      C      = THIRD COEFFICIENT IN THE EQUATION- Y=A+B*X+C*X**2
C             = D12 IN QIRE NOTATION
C      N1     = EXIT VALUE OF QV(5).  N1=4 IF  X  IS THE PRECICTED MAX PT.
C               N1=+5(-5) IF X IS JUST TO THE LEFT(RIGHT) OF THE PREVIOUSL
C               PREDICTED MAX PT. N1=6 IF X IS THE SECOND PT CLOSE TO THE
C               OTHERWISE N1=N.
C      M      = ENTRY VALUE OF QV(5)
C      SGM    = SIGN OF  M  IF ABS(M)=5
C      SDYDX  = SIGN OF THE SLOPE OF THE CURVE
C      XJ     = JUMP TO BE TAKEN FROM LAST  X
C      XJA    = ABSOLUTE VALUE OF MAXIMUM JUMP = ABS(XJP)
C      XM     = DISTANCE FROM CENTRAL PT TO MAX/MIN OF PARABOLA. =XMAX-XX(
C               OR = DISTANCE FROM CENTRAL PT TO THE ROOT.  =XROOT-XX(2)
C      X1     = INPUT (OR LAST) X VALUE

       COMMON /CQIREM/ YTOL,YO,DYDX,CTRMAX
       COMMON /ERASE / BOT,C,DXDY,E,I,II,IN,ISPAN,M,N,RADICL,SDYDX,SGN,
      1               TOP,X1,X13,X13P,XJ,XJA,XM, DX(3),DY(3),QV1(10)
        DIMENSION XX(4),YY(4)
        EQUIVALENCE (CTR,QV1(1)), (N1,QIND,QV1(5)),
      1               (XX,QV1(2)), (YY,QV1(6))

C     INITIALIZING  AND  PRELIMINARY CHECKING
       IF(CTRMAX.EQ.0.) CTRMAX=25.
       DO 30 I=1,8
   30   QV1(I)= QV(I)
       N1     = IFIX(QV1(5))
       E      = Y-YO
       M      = N1
       IF(CTR.EQ.0.) M=0
       SGM    = 1.
       IF(M.GE.0) GO TO 36
       M      = 5
       SGM    = -1.
   36 N       = MINO(M,3)
```

```
C      SDYDX = SIGN(1.,-XJP)
C      (ALTERNATE CALC TO CIRCUMVENT COMPILER ERROR)
       IF(XJP) 41,42,42
   41  SDYDX = 1.
       GO TO 43
   42  SDYDX = -1.
   43  XJA    = ABS(XJP)
       X1     = X
       IF(M-5) 44,45,46
   44  IF(ABS(E).LE.YTOL) GO TO 800
       IF(M.EQ.4 .AND. ABS(E-YY(2)).LE.YTOL) GO TO 700
       IF(CTR.GE.CTRMAX) CALL ERRORK(KNAME)
       GO TO 50
   46  M      = 3
   45  X13P   = XX(3)-XX(1)

C     DETERMINE INDEX FOR INSERTING CURRENT X,E INTO XX,YY TABLE WHICH IS
C      ORDERED ACCORDING TO X.
   50  IN     = 1
       IF(N.EQ.0)        GO TO 90
   60   IF(XX(IN).GT.X1) GO TO 70
        IN     = IN+1
        IF(IN.LE.N)      GO TO 60
       GO TO 90

C     RELOCATE IN PREPARATION FOR INSERTING  X,E
   70  II     = N+1
   80   XX(II)= XX(II-1)
        YY(II)= YY(II-1)
        II     = II-1
        IF(II.NE.IN) GO TO 80

C     INSERT NEW POINT
   90  N      = N+1
       XX(IN)= X1
       YY(IN)= E

C     LOCATE INTERVAL WHICH SPANS ROOT
       ISPAN = 0
       IF(N.EQ.1) GO TO 200
        DO 110 I=2,N
        IF(SDYDX*YY(I).GT.0. .AND. SDYDX*YY(I-1).LT.0.) ISPAN=I
  110   CONTINUE

C     REDUCE  XX,YY TABLE TO THREE POINTS
       IF(N.LE.3)       GO TO 200
       IF(ISPAN.EQ.0) GO TO 140
C      (ROOT HAS BEEN SPANNED)
  122  IF(ISPAN.EQ.N) GO TO 150
       IF(ISPAN.EQ.2) GO TO 175
       IF(ABS(YY(1)).GT.ABS(YY(4))) GO TO 150
       GO TO 175

C      (ROOT HAS NOT BEEN SPANNED)
  140  IF(IN.LE.2)      GO TO 175

C      DELETE FIRST POINT
  150   DO 160 I=1,N
        XX(I) = XX(I+1)
  160   YY(I) = YY(I+1)
       ISPAN = ISPAN-1
```

```
C      DELETE FOURTH POINT
  175 N       = N-1

C     SIMPLE X-JUMP PREDICTION
  200 N1      = N
      IF(ISPAN.GT.0 .OR. DYDX.NE.0.) GO TO 205
C     XJ      = SDYDX*SIGN(XJA,-E)
C     (ALTERNATE CALC TO CIRCUMVENT COMPILER ERROR)
      XJ      = XJP
      IF(E.LT.0.) XJ=-XJ
      GO TO 900

C     CURVE FIT PREDICTIONS
  205 IF(N-2) 210,220,300

C     ONE POINT PREDICTION BASED ON INPUT VALUE OF DXDY
  210 XJ      = -E/DYDX
      GO TO 900

C     TWO POINT STRAIGHT LINE PREDICTION
  220 BOT     = YY(2)-YY(1)
      IF(BOT.EQ.0.) GO TO 230
      DXDY    = (XX(2)-XX(1))/BOT
      IF(DXDY*SDYDX.GT.0.) GO TO 240
C     (CURVE SLOPE IS WRONG - MOVE TOWARD MAXIMUM POINT)
  230 XJ      = -3.*SDYDX*XJA
      GO TO 900
C     (CURVE SLOPE IS CORRECT)
  240 XJ      = -E*DXDY
      GO TO 900

C     PARABOLIC CURVE FIT PREDICTION
  300 DX(1) = XX(1)-XX(2)
      DX(3) = XX(3)-XX(2)
      DY(1) = YY(1)-YY(2)
      DY(3) = YY(3)-YY(2)
      BOT   = DX(1)*DY(3) - DX(3)*DY(1)
      IF(ABS(BOT).LT.1.E-12) GO TO 600
      TOP   = DX(1)*DX(1)*DY(3) - DX(3)*DX(3)*DY(1)
      XM    = .5*TOP/BOT
      X13   = XX(3)-XX(1)
      IF(ABS(XM).GT.ABS(1.E3*X13)) GO TO 600
      C     = BOT/(DX(1)*DX(3)*X13)
      RADICL= XM*XM - YY(2)/C
      IF(RADICL.LE.0.) GO TO 360
      SGN   = SIGN(1.,SDYDX*C)
      XM    = XM + SGN*SQRT(RADICL)
      GO TO 890
C     (IMAGINARY ROOT, HENCE WE ARE LOOKING FOR THE MAXIMUM POINT,
C     PREDICT MAX PT IF M=3, SELECT PTS ON LEFT/RIGHT SIDE OF PREVIOUSLY
C     PREDICTED PT IF M=4/5)
  360 IF(M-4) 363,364,365
  363 IF(ABS(XM).LT.XJA) N1=4
      GO TO 890
  364 XJ      = -X13/8.
      N1      = 5
      IF(IN.GT.2) GO TO 900
      XJ      = -XJ
      N1      = -5
      GO TO 900
  365 XJ      = SGM*X13P/4.
```

```
      N1     = 6
      GO TO 900
C     RETREAT TO LINEAR INTERPOLATION
  600 IF(ISPAN.GT.0) GO TO 122
      GO TO 140
C     MAXIMUM FOUND
  700 QIND   = 0.
      GO TO 930
C     SOLUTION FOUND
  800 CTR    = 0.
      GO TO 930
C     FINIS
  890 X1     = XX(2)+XM
      GO TO 910
  900 X1     = X1+XJ
  910 CONTINUE
      X      = AMAX1(XX(1)-XJA,AMIN1(X1,XX(N)+XJA))
      CTR    = CTR+1.
  930 DO 950 I=1,8
  950 QV(I)  = QV1(I)
      QV(5)  = FLOAT(N1)
  999 RETURN
      END
```

```
*DECK SS5PT
      SUBROUTINE SS5PT
*SS5PT             SUPERSONIC 5-PT FORMULA                        *SS5PT*

C     INPUT-
C      X(1-4)= POINT SPACING FROM POINT ZERO
C      A4FACT= 1 FOR CUBIC, =0 FOR SAME A4 AS A PARABOLA

C     OUTPUT-
C      A0,A1,A2,A3,A4= INFLUENCE COEFFICIENTS FOR D2Y/DX2 AT X(4)

      COMMON /CSS    / SSFML,SSEF,SSEANG,SSDF,SSFEND,SSFND1
     1                ,SSDLE,A4FACT,BRLX,CURRLX,TSIC
       INTEGER         SSFML
       LOGICAL                  SSEF,        SSDF,    SSDLE

      COMMON /CSS5PT/ X(4),Y(4), X21,X31,X32,X41,X42,X43, A0,A1,A2,A3,A4

      X43    = X(4)-X(3)
      X42    = X(4)-X(2)
      X41    = X(4)-X(1)
      X32    = X(3)-X(2)
      X31    = X(3)-X(1)
      X21    = X(2)-X(1)

      A4     = 2./(X42*X43)*(1.+A4FACT*(X42+X43)/X41)
      A1     = (-A4*X(4)*X42*X43 + 2.*(X(4)+X42+X43))/
     1         (X(1)*X21*X31)
      A2     = (+A4*X(4)*X41*X43 - 2.*(X(4)+X41+X43))/
     1         (X(2)*X21*X32)
      A3     = (-A4*X(4)*X41*X42 + 2.*(X(4)+X41+X42))/
     1         (X(3)*X31*X32)
      A0     = -(A1+A2+A3+A4)

      RETURN
      END
```

```
*DECK TABPRT
      SUBROUTINE TABPRT(NAME, A,NA,NCOL1)
CTABPRT--- CDC VERSION
      DIMENSION A(10)
C     INPUT*
C      NAME  = ARRAY NAME TO BE PRINTED
C      A     = ARRAY TO BE PRINTED
C      NA    = NUMBER OF ELEMENTS
C      NCOL1 = NUMBER OF COLS. TO BE USED IN PRINT FORMAT
C      $$$$$   (MAXIMUM = NA )
C      I1TAB = LOC. OF FIRST ELEMENT IN A TO BE PRINTED
C
       COMMON /CBITS  / IBITS,BLANK
       COMMON /CTABPR/ I1TAB
       EQUIVALENCE     (LSPACE,ASPACE) , (IB,B)
       DIMENSION FMT(12)
       REAL  I12
       INTEGER  HOLL,HTEST
       DATA IBCI/0010000000000/
       DATA (FMT(J),J=1,12)/10H(1X,I5    ,10H          ,10H          ,
      *10H          ,10H          ,10H          ,10H          ,
      *10H          ,10H          ,10H          ,10H          ,
      *10H          )/
       DATA
      * F1,        F8,        F6,        E5,        BCD,       OCT,      I12/
      *6H,F12.1, 6H,F12.3, 6H,F12.6, 6H,E12.4, 6H,6X,A6, 6H,8X,O4, 4H,I12
      */
       DATA HMASK/00000000000077777777/ , HTEST/00000000000055555555/,
      *      INMASK/03777777700000000000/
       DATA NINMSK/07777000000000000000/

       NCOL  = MIN0(NCOL1,10)
       NB    = NA

C     WRITE  HEADING
       WRITE (6,1000) NAME

   45 I1    = I1TAB
      I     = I1
      I2    = 0

C     WRITE LINE SPACE
   47 WRITE (6,1002)
C     LOCATION OF NEXT LINE SPACE IS GIVEN BY A(I+1)
       ASPACE= A(I+1)
       IF( LSPACE.LE.1 .OR. LSPACE.GE.IBCI ) LSPACE=IBCI
       LSPACE= LSPACE+I-1
       GO TO 110

C     BEGIN LOOP TO DEFINE LINE FORMAT
   48 II     = 1
C
   50 B      = A(I)

C     SPECIAL NUMBERS
       NN     = NINMSK.AND.B
       IF( NN.EQ.NINMSK ) GO TO 82
C     TEST FOR HOLLERITH (6H-----  MAX.)
       HOLL    = HMASK.AND.B
       IF( HOLL.EQ.HTEST ) GO TO 80
C     TEST FOR INTEGER  (BITS 36-58=0 FOR MAX 635 INTEGER
C     FLOATING POINT NUMBERS NORMALIZED
```

```
      IF( IB.EQ.IBITS ) GO TO 85
      INTGR = INMASK.AND.IB
      IF( INTGR.EQ.0 ) GO TO 82
C     REAL NUMBER -- NORMALIZED
      B      = ABS(B)
      FMT(II+1)= E9
      IF( B.LT.1.E-3 .OR. B.GE.1.E8 ) GO TO 90
   65 FMT(II+1)= F6
      IF( B.GE.1.E8 ) FMT(II+1)=F3
      IF( B.GE.1.E5 ) FMT(II+1)=F1
      GO TO 90

C     BCD
   80 FMT(II+1)= BCD
      GO TO 90

C     INTEGER
   82 FMT(II+1)= I12
      GO TO 90

C     OCTAL
   85 FMT(II+1)= OCT
   90 II     = II+1
      I      = I+1
      IF( I.GT.LSPACE ) GO TO 100
      IF( II.LE.NCOL .AND. I.LE.NB ) GO TO 50
  100 I2     = I-1
      WRITE (6,FMT) I1,(A(K),K=I1,I2)
      I1     = I
  110 IF( I.GE.NB ) GO TO 990
      IF( I.GT.LSPACE ) GO TO 47
      GO TO 48
  990 I1TAB = 1
 1000 FORMAT(/2X,A6)
 1002 FORMAT(1H )
      RETURN

      END
```

```
*DECK TAN
      FUNCTION TAN(X)
*TAN--*                                                        *TAN*
      TAN    = SIN(X)/COS(X)
      RETURN
      END
```

```
*DECK LBDYBL
      FUNCTION  LBDYBL(BNAME,LOWER)
CLBDYBL          LOCATE INDEX IN BL INPUT TABLE
      LOGICAL            LOWER
      INTEGER            BNAME
C
C     BOUNDARY TABLE
C      INDEX= LB=LBDO,LBDE
C      LBNEXT= INCREMENT TO NEXT BOUNDARY
C      LBZ1  = INCREMENT TO THE FIRST BOUNDARY POINT (=0 BEFORE COALLATIO
C      CHNAME= CHANNEL WITH WHICH THE BOUNDARY DATA IS ASSOCIATED
C      UP    = T OR F FOR UPPER OR LOWER BOUNDARY
C      LEDEX = RELATIVE INDEX OF L.E. POINT WHEN LOWER AND UPPER SURFACE
C              CONTOURS ARE CONNECTED
C      BDNAME,LBA,LBB=NAME AND INDEX LIMITS OF SPECIFIC BOUNDARY
C                     DATA WHEN BOUNDARIES ARE COALLATED
      COMMON /CHDATA/ BDT(1),LBNEXT(1),LBZ1(1),
     1                CHNAME(1),UP(1),LEDEX(1),
     2                ZBT(1),RBT(1),ANGBT(42)
       LOGICAL        UP
       INTEGER BDT,CHNAME,BDNAME
       DIMENSION      BDNAME(1),LBA(1),LBB(1)
       EQUIVALENCE    (BDNAME,ZBT), (LBA,RBT), (LBB,ANGBT)
C
      COMMON /BLDTA1/ BNAMSV
       INTEGER        BNAMSV
      COMMON /BCOLUT/ ZBCOL
      COMMON /CBITS  / IBITS,IBLANK
      EQUIVALENCE (BITS,IBITS)

C     LBDYBL=0  IF NO BOUNDARY LAYER
C     LBDYBL=INDEX OF BOUNDARY IN BL INPUT TABLE

      COMMON /BLBDY / BLB(60)
      DIMENSION IBLB(60)
      EQUIVALENCE  (IBLB,BLB)

      ZBCOL  = BITS
      BNAMSV= BNAME
      LBDYBL = 0
    1 LB     = LBF(BNAME)
      NCOLLB= LBZ1(LB)/3
      ASSIGN 20 TO LGO
      ASSIGN 40 TO JGO
      ASSIGN 140 TO KGO
      IBDC   = BDT(LB)
      IF( NCOLLB ) 5,5,2
C    SEQUENCE FOR COLLATED BOUNDARIES
    2 ASSIGN 10 TO LGO
      ASSIGN 3 TO KGO
      ASSIGN 3 TO JGO
      LBC    = LB-3
      NCOLB1= NCOLLB
      IF(LEDEX(LB).EQ.0) GO TO 222
      IF (.NOT.LOWER) GO TO 223
      LBC    = LB
      NCOLB1= NCOLLB-1
      GO TO 222
  223 ASSIGN 20 TO LGO
      ASSIGN 40 TO JGO
      ASSIGN 140 TO KGO
  222 NBC    = 0
```

```
  3 IF( NBC.GE.NCOLB1 ) GO TO 40
    NBC    = NBC+1
    LBC    = LBC+3
  4 IBDC   = BDNAME(LBC)
  5 IBL    = -2
  6 IBL    = IBL+3
    IF( IBLB(IBL).EQ.IBDC ) GO TO LGO,(20,10)
    IF( IBL.GE.58 .OR. IBLB(IBL).EQ.IBITS) GO TO KGO,(140,3)
    GO TO 6
 10 LBT    = LB+LBZ1(LB)+LBA(LBC)
    IF(LOWER) GO TO 12
    LBT    = LB+LBZ1(LB)+LBB(LBC)
 12 ZBCOL  = ZBT(LBT)
 20 IF( IBLB(IBL+1).EQ.0 ) GO TO JGO,(40,3)
    LBDYBL= IBL
 40 RETURN
140 CALL ERRORK(6HLBDYBL)
    GO TO 40
    END
```

```
*DECK STANO
      SUBROUTINE STANO(M,LR,UPPER)
*STANO*           STATION INDEX FROM FIELD POINT                  *STANO*
       LOGICAL              UPPER

C     INPUT-
C      M      = FIELD PT INDEX
C      LR     = 0 FOR FIRST ENTRY OTHERWISE LR.NE.0
C     OUTPUT-
C      LR     = STATION TABLE INDEX
C      UPPER = T IF  M  IS AN UPPER BOUNDARY POINT. =F OTHERWISE

C     STATION TABLE
C      INDEX= L=LO,LESTA
C      SCHOKE= STATION CHOKE INDICATOR (ADJWF,BRHS,WRIOUT)
C      MCL   = SHARP CORNER INDICATOR (BLDTBS)
C      MCL   = FIELD INDEX OF CONTROL STREAMLINE (PTMOVE,FLOBAL)
       COMMON /CHDATA/ X1(1),LNEXT(1),MLB(1),MUB(1),PRIM(1),
     1                 TYPELB(1),NAMELB(1),ILB(1),FLB(1),S1LB(1),
     1                 TYPEUB(1),NAMEUB(1),IUB(1),FUB(1),S1UB(1),
     &                 VMB(1),DWDV(1),X2CL(1),SLSWI(1),MCL(1),
     &                 ANGTE(1),PTTE(1),PSTE(1),FGRTE(1),RGTE(1),
     &                 ANGEXP(1),BSQEXP(475)
       DIMENSION       CRVLE(1),ANGLE(1)
       EQUIVALENCE     (SCHOKE,DWDV),(CRVLE,ANGTE),(ANGLE,PTTE)
       INTEGER         PRIM,TYPELB,TYPEUB,SCHOKE(1)
C
       COMMON /IXORIG/ LHO,LHE, LBDO,LBDE, LTO,LTE, LWO,LWE, LFO,LFE,
     *                 LO,LESTA,  LDUM(8),
     *                 MO,NM, NJ,NFCOLS, MAXNJ,MAXOL,MAXNM,MAXLE,
     *                 LEO,LEE, LRO,LRE,LRD
       DIMENSION       LIMITS(24)
       EQUIVALENCE     (LIMITS,LHO)
       DATA KNAME/6HSTANO /

       L      = LR
       IF(L.EQ.0) L = LO
       UPPER = .FALSE.
       LSAV  = L
       LSTOP = 999999

  120  IF(L.GE.LSTOP) CALL ERRORK(KNAME)
       IF(MUB(L).EQ.M) GO TO 150
       IF(M.GE.MLB(L) .AND. M.LE.MUB(L)) GO TO 160
       L      = L+LNEXT(L)
       IF(L.LT.LESTA) GO TO 120
       L      = LO
       LSTOP = LSAV
       GO TO 120

  150  UPPER = .TRUE.
  160  LR     = L

       RETURN
       END
```

```
*DECK STAX1
      SUBROUTINE STAX1(X1FIND,X2B,X2A,LXB,LXA)
*STAX1-           STATION INDEX FROM X1 AND X2-COORDINATES    *STAX1*

C     INPUT-
C      X1FIND= X1-COORDINATE
C      X2B    = X2-COORDINATE OF UPPER BOUNDARY (I.E. STATION BELOW THE BO
C      X2A    = X2-COORDINATE OF LOWER BOUNDARY (I.E. STATION ABOVE THE BO

C     OUTPUT-
C      LXB    = INDEX OF STATION WHICH CONTAINS COORDINATES-X1FIND,X2B
C      LXA    = INDEX OF STATION WHICH CONTAINS COORDINATES=X1FIND,X2A

C     STATION TABLE
C      INDEX- L=LO,LESTA
C      SCHOKE= STATION CHOKE INDICATOR (ADJWF,BRHS,WRIOUT)
C      MCL    = SHARP CORNER INDICATOR (BLDTBS)
C      MCL    = FIELD INDEX OF CONTROL STREAMLINE (PTMOVE,FLOBAL)
       COMMON /CHDATA/ X1(1),LNEXT(1),MLB(1),MUB(1),PRIM(1),
     1                 TYPELB(1),NAMELB(1),ILB(1),FLB(1),S1LB(1),
     1                 TYPEUB(1),NAMEUB(1),IUB(1),FUB(1),S1UB(1),
     &                 VMB(1),DWDV(1),X2CL(1),SLSWI(1),MCL(1),
     &                 ANGTE(1),PTTE(1),PSTE(1),FGRTE(1),RGTE(1),
     &                 ANGEXP(1),BSQEXP(475)
         DIMENSION     CRVLE(1),ANGLE(1)
         EQUIVALENCE   (SCHOKE,DWDV),(CRVLE,ANGTE),(ANGLE,PTTE)
         INTEGER       PRIM,TYPELB,TYPEUB,SCHOKE(1)
C
       COMMON /IXORIG/ LHO,LHE, LBDO,LBDE, LTO,LTE, LWO,LWE, LFO,LFE,
     *                 LO,LESTA,  LDUM(8),
     *                 MO,NM, NJ,NFCOLS, MAXNJ,MAXOL,MAXNM,MAXLE,
     *                 LEO,LEE, LRO,LRE,LRD
        DIMENSION      LIMITS(24)
        EQUIVALENCE    (LIMITS,LHO)
       COMMON /SLTAB / W(128),X2(128),SLCHN(128)
        INTEGER SLCHN
       COMMON /CIDEX / M,J,MU,MD,ISTAG
       DATA KNAME/6HSTAX1 /

       NFOUND= 0
       IF(X2B.GE.0.) NFOUND=1
       IF(X2A.GE.0.) NFOUND=NFOUND+1
       L      = LO

  110  IF(X1(L).NE.X1FIND) GO TO 120
       M      = MUB(L)
       CALL GETIX
       IF(X2(J).NE.X2B) GO TO 115
       LXB    = L
       NFOUND= NFOUND-1
       GO TO 120
  115  M      = MLB(L)
       CALL GETIX
       IF(X2(J).NE.X2A) GO TO 120
       LXA    = L
       NFOUND= NFOUND-1
  120  L      = L+LNEXT(L)
       IF(NFOUND.EQ.0) GO TO 130
       IF(L.LT.LESTA) GO TO 110
       CALL ERRORK(KNAME)

  130  RETURN
```

END

```
*DECK STCN
      OVERLAY(STC,1,0)
      PROGRAM STCN
      COMMON /CTAPOS/  RESTRT,ENDBDY,STCFIL,K6SV
      LOGICAL          RESTRT,ENDBDY,STCFIL
      COMMON /SELECT/ LENTRY
    1 GO TO  (5,10) , LENTRY
C    READ INPUT
    5 CALL OVERLAY(3HSTC,1,1,6HRECALL)
      GO TO 20
C    BUILD TABLES
   10 IF(RESTRT) GO TO 15
      LENTRY= 1
      CALL OVERLAY(3HSTC,1,2,6HRECALL)
      CALL OVERLAY(3HSTC,1,3,6HRECALL)
      LENTRY= 2
   12 CALL OVERLAY(3HSTC,1,2,6HRECALL)
      CALL OVERLAY(3HSTC,1,4,6HRECALL)
      GO TO 20
C  RESTRT CASE
   15 LENTRY= 2
      CALL OVERLAY(3HSTC,1,3,6HRECALL)
      LENTRY= 3
      CALL OVERLAY(3HSTC,1,2,6HRECALL)
   20 RETURN
      END
```

```
*DECK ERRORN
      SUBROUTINE ERROR1
CEDUMPN           STC EDUMP - INPUT LINK                                *EDUMPN*

C  COMALL
C   CHANNEL INPUT DATA TABLE
C     INDEX- LH=LHO,LHE
      DIMENSION            CHNAM(1),LHNEXT(1),WTFLOW(1),TTO(1),PTO(1),
     1                     TSO(1),PSO(1),MACHO(1),AO(1),VARY(1),
     2                     RG(1),GAM(1), NR(1),NC(1),TAB(6),
     4                     BB(75)
       LOGICAL             VARY
       INTEGER CHNAM
       DIMENSION           VO(1)
       REAL                MACHO
       EQUIVALENCE         (VO,MACHO)
C    BOUNDARY TABLE
C     INDEX- LB=LBDO,LBDE
C     LBNEXT= INCREMENT TO NEXT BOUNDARY
C     LBZ1  = INCREMENT TO THE FIRST BOUNDARY POINT (=0 BEFORE COALLATIO
C     CHNAME= CHANNEL WITH WHICH THE BOUNDARY DATA IS ASSOCIATED
C     UP    = T OR F FOR UPPER OR LOWER BOUNDARY
C     LEDEX = RELATIVE INDEX OF L.E. POINT WHEN LOWER AND UPPER SURFACE
C             CONTOURS ARE CONNECTED
C     BDNAME,LBA,LBB=NAME AND INDEX LIMITS OF SPECIFIC BOUNDARY
C                   DATA WHEN BOUNDARIES ARE COALLATED
      DIMENSION            BDT(1),LBNEXT(1),LBZ1(1),
     1                     CHNAME(1),UP(1),LEDEX(1),
     2                     ZBT(1),RBT(1),ANGBT(42)
       LOGICAL             UP
       INTEGER BDT,CHNAME,BDNAME
       DIMENSION           BDNAME(1),LBA(1),LBB(1)
       EQUIVALENCE         (BDNAME,ZBT), (LBA,RBT), (LBB,ANGBT)
C    TABLE OF CONVECTED PROPERTIES
C     INDEX- LT=LTO,LTE
C     CH    = CHANNELNAME
C     LTNEXT= INDEX INCREMENT TO THE NEXT CHANNEL
C     LPSI  = RELATIVE LOCATION OF PSI LIST
C     NPT   = NO. OF PSI, TT, PT AND RCU VALUES
C     LTT   = RELATIVE LOCATION OF TT LIST
C     LPT   = RELATIVE LOCATION OF PT LIST
C     LRCU  = RELATIVE LOCATION OF RCU LIST
      DIMENSION            CH(1),LTNEXT(1),NPT(1),LPSI(1),LTT(1),LPT(1),
     1                     LRCU(1),
     2                     CRG(1),CPGJ(1),C2CP(1),QGAM(1),FGT(1),FGP(1),
     3                     FGR(1),AREATB(485)
       DIMENSION           XCH(1)
       EQUIVALENCE         (CH,XCH)
C    TABLE OF WAKE DISPLACEMENT THICKNESS
C     INDEX- LW=LWO,LWE
      DIMENSION                  X2W(1),LWNEXT(1),S1W(47)
       DIMENSION           DST(1)
       EQUIVALENCE         (DST,S1W)
C     SUBTABLE ARRANGEMENT IS=
C      X2W,LWNEXT(=2+2N), S1W(1),S1W(2),..,S1W(N), DST(1),DST(2),..,DST(N)
C     X2W   = STREAMLINE COORDINATE
C     S1W   = DISTANCE ALONG STREAMLINE FROM T.E.
C     DST   = WAKE DISPLACEMENT THICKNESS AS A FUNCTION OF S1W
C    FLOW ADJUSTMENT TABLE
C     INDEX- LF=LFO,LFE
C     NFCOLS= 8
C     X1F   = ORTHOGONAL COORDINATE
```

```
C      X2F    = STREAMLINE COORDINATE OF SL EMINATING FROM T.E.
C      X1BF   = X1-COORDINATE OF CHOKE STATION OF FLOW BELOW T.E.
C      X1AF   = X1-COORDINATE OF CHOKE STATION OF FLOW ABOVE T.E.
C      S1F    = S1-COORDINATE OF T.E. (UPPER SURFACE), THIS ITEM
C               IS USED WHEN INTERPOLATING FOR WAKE DELTA-STAR.
C      LFB,LFA=INDICES OF STATIONS BELOW AND ABOVE T.E.
C      NCHB,NCHA=NUMBER OF CHANNELS BELOW AND ABOVE T.E.
C      LRF    = INDEX OF DUMMY ORTCHN LIST FOR THE T.E.
C      LRXF   = INDEX OF LAST CHANNEL BELOW THE T.E.
C      JORDER= 0 IF TOTAL FLOW AT X1F IS GIVEN
C            = 2 IF FLOW ABOVE T.E. IS GIVEN
C            = 1 IF FLOW BELOW T.E. IS GIVEN
C      JORDER= -1 IF FLOW AT X1F IS CHOKED AND SINGLE CHANNEL
       DIMENSION        X1F(1),X2F(1),X1BF(1),X1AF(1),
     1                  S1F(1),NCHB(1),NCHA(1),JORDER(1),VNR(12)
       EQUIVALENCE      (LFB,X1BF),(LFA,X1AF),(LRF,NCHB),(LRXF,NCHA)
       DIMENSION        LFB(1),LFA(1),LRF(1),LRXF(1)
C      STATION TABLE
C       INDEX- L=LO,LESTA
C       SCHOKE= STATION CHOKE INDICATOR (ADJWF,BRHS,WRIOUT)
C       MCL   = SHARP CORNER INDICATOR (BLDTBS)
C       MCL   = FIELD INDEX OF CONTROL STREAMLINE (PTMOVE,FLOBAL)
       COMMON /CHDATA/ X1(1),LNEXT(1),MLB(1),MUB(1),PRIM(1),
     1                 TYPELB(1),NAMELB(1),ILB(1),FLB(1),S1LB(1),
     1                 TYPEUB(1),NAMEUB(1),IUB(1),FUB(1),S1UB(1),
     &                 VMB(1),DWDV(1),X2CL(1),SLSWI(1),MCL(1),
     &                 ANGTE(1),PTTE(1),PSTE(1),FGRTE(1),RGTE(1),
     &                 ANGEXP(1),BSQEXP(475)
        DIMENSION      CRVLE(1),ANGLE(1)
        EQUIVALENCE    (SCHOKE,DWDV),(CRVLE,ANGTE),(ANGLE,PTTE)
        INTEGER        PRIM,TYPELB,TYPEUB,SCHOKE(1)
       EQUIVALENCE     (CHNAM,BDT,CH,X2W,X1F,X1)
       EQUIVALENCE     (LHNEXT,LBNEXT,LTNEXT,LWNEXT,X2F,LNEXT)
       EQUIVALENCE     (WTFLOW,LBZ1,NPT,S1W,X1BF,MLB)
       EQUIVALENCE     (TTO,CHNAME,LPSI,X1AF,MUB), (PTO,UP,LTT,S1F,PRIM)
       EQUIVALENCE     (TSO,LEDEX,LPT,NCHB,TYPELB)
       EQUIVALENCE     (PSO,ZBT,LRCU,NCHA,NAMELB)
       EQUIVALENCE     (MACHO,RBT,CRG,JORDER,ILB), (AO,ANGBT,CPGJ,VNR,FLB)
       EQUIVALENCE     (VARY,C2CP,S1LB), (RG,QGAM,TYPEUB)
       EQUIVALENCE     (GAM,FGT,NAMEUB), (NR,FGB,IUB), (NC,FGR,FUB)
       EQUIVALENCE     (TAB(1),AREATB,S1UB),(BB,ANGTE)
       EQUIVALENCE     (TAB(4),X2CL),(TAB(5),SLSWI),(TAB(6),MCL)
C
       COMMON /ALLCOM/ MACHA,PSA,TSA,PTA,TTA, AXIA,RGA,GAMA,
     1                 MACHC,PSC,TSC,PTC,TTC, AXIC,RGC,GAMC,
     2                 DAXIT,SCALEA,TTE,CHOTST
       REAL            MACHA(1),MACHC
       LOGICAL         AXIA,AXIC
       LOGICAL         CHOTST
C      STREAMLINE TABLE
       COMMON /SLTAB / W(128),X2(128),SLCHN(128)
        INTEGER SLCHN

C      FIELD TABLES
C       INDEX- M=MO,NM
       COMMON /CZ    / Z(300)
       COMMON /CR    / R(300)
       COMMON /CS2   / S2(300)
       COMMON /CS1   / S1(300)
       COMMON /CPHI1 / PHI1(300)
       COMMON /CM    / JMS(300)
```

```
      COMMON /CCURV / CURV(300)
      COMMON /CB    / B(300)
      COMMON /CIDEX / M,J,MU,MD,ISTAG

C     TABLE OF INDEX LIMITS
      COMMON /IXORIG/ LHO,LHE, LBDO,LBDE, LTO,LTE, LWO,LWE, LFO,LFE,
     *                LO,LESTA,LSO,LSE,LDO,LDE,LDUM(4),
     *                MO,NM, NJ,NFCOLS, MAXNJ,MAXOL,MAXNM,MAXLE,
     *                LEO,LEE, LRO,LRE,LRD
       DIMENSION      LIMITS(24)
C     TABLE OF LEADING EDGE AND TRAILING EDGE POINTS
C      INDEX- LE=LEO,LEE,10
C      NLE,NTE=NO. OF L.E. AND T.E. COINCIDENT PTS. RESPECTIVELY
C      CHL,CHU=NAME OF CHANNEL ABOVE AND BELOW PT, RESPECTIVELY
C      BDL,BDU=BOUNDARY NAMES ASSOCIATED WITH THE POINTS
C      NUSED = COUNT OF TIMES THAT POINT USED IN CONSTRUCTION OF /ORTCHN/
      COMMON /LETEPT/ XE(1),YE(1),ANGE(1),NLE(1),NTE(1),
     1                CHL(1),CHU(1),BDL(1),BDU(1),NUSED(491)
       INTEGER        CHL,CHU,BDL,BDU
C     TABLE OF CHANNELS EMBRACED BY EACH ORTHOGONAL
C      INDEX- LR=LRO,LRE,LRD
C      LRD    = NUMBER OF CHANNELS PLUS ONE,   LR INDEX INCREMENT
C      LEDGE = INDEX OF THE ORTHOGONAL POINT IN THE LETEPT-TABLE
C      LRPREV= POINTER OF LINE OF UPSTREAM CHANNELS IN ORTCHN-TABLE
C      CHNA  = CHANNEL NAMES
      COMMON /ORTCHN/ LEDGE(1),LRPREV(1),CHNA(479)
       INTEGER CHNA
       DIMENSION      JCHNA(1)
       EQUIVALENCE    (JCHNA,CHNA)

       EQUIVALENCE   (LHNEXT,LBNEXT,LTNEXT,LWNEXT,X2F,LNEXT)
       EQUIVALENCE   (WTFLOW,LBZ1,NPT,S$W,X1BF,MLB)
       EQUIVALENCE   (TTO,CHNAME,LPSI,X1AF,MUB), (PTO,UP,LTT,S1F,PRIM)
       EQUIVALENCE   (TSO,LEDEX,LPT,NCHB,TYPELB)
       EQUIVALENCE   (PSO,ZBT,LRCU,NCHA,NAMELB)
       EQUIVALENCE   (MACHO,RBT,CRG,JORDER,ILB), (AO,ANGBT,CPGJ,VNR,FLB)
       EQUIVALENCE   (VARY,C2CP,S1LB), (RG,QGAM,TYPEUB)
       EQUIVALENCE   (GAM,FGT,NAMEUB), (NR,FGP,IUB), (NC,FGR,FUB)
       EQUIVALENCE   (TAB(1),AREATB,SIUB), (TAB(2),VMB), (TAB(3),DWDV)

      COMMON /CBITS / BITS,BLANK
      COMMON /CDS2  / DS2(300)
      COMMON /CLINES/ LINES,OMITFK,PTITLE(6)
       LOGICAL        OMITFK
      COMMON /CREDIN/ ZTRANS,RTRANS,ROTATE,ZPIVOT,RPIVOT,SCALE,NB,TBB(9)
       EQUIVALENCE    (XTRANS,ZTRANS),(YTRANS,RTRANS),(XPIVOT,ZPIVOT),
     1                (YPIVOT,RPIVOT)
      COMMON /CRHS  / RHS(300)
      COMMON /CTABRR/ I1TAB
      COMMON /CVM   / VM(300)

      COMMON /CSEGME/ IA(10),IB(10),IMA(10),IMB(10),JTYPE(10),
     1                N,NSEG, NI,NIB
      COMMON /CSMOOB/ XA(100),YA(100),DEVI(100)
      COMMON /CSMOOC/ DUM1(200),ANG(100),DUM2(400),DEV(100),CURVB(100)
      COMMON /BLBDV / IBLB(60)
      DATA TXA/2HXA/,TZA/2HZA/

      IGGO  = 1
      GO TO 1777
      ENTRY EDUMP
```

```
      IGGO   = 2
 1777 CONTINUE
 1100 FORMAT(///1X36HCHANNEL INPUT DATA TABLE, /CHDATA/ -)
      WRITE (6,1100)
      I1TAB = LHO
      NCX   = NC
      IF(NCX.LT.3) NCX=5
      CALL TABPRT(BLANK,CHNAM,LHE,NCX)

 1120 FORMAT(///1X54HBOUNDARY COORDINATES AND ANGLES IN RADIANS, /BDYTAB
     */ -)
      WRITE (6,1120)
      I1TAB = LBDO
      CALL TABPRT(BLANK,BDT,LBDE,3)

 1110 FORMAT(///1X41HTABLE OF CONVECTED PROPERTIES, /CONVTB/ -)
      WRITE (6,1110)
      I1TAB = LTO
      CALL TABPRT(BLANK,CH,LTE,7)

      IF(LEE.LT.LEO) GO TO 140
 1130 FORMAT(///1X125HORDERED LIST OF UPSTREAM BOUNDARY PNTS, L.E. PNTS,
     * T.E. PNTS, AND DOWNSTREAM PNTS WITH REFERENCES TO CHANNELS AND BO
     *UNDARIES./1X10H/LETEPT/ =//4X2HLE6X,2HXB10X,15HYE             ANGE12X,
     *3HNLE9X,12HNTE        CHL9X,3HCHU9X,3HBDL9X,3HBDU10X,5HNUSED)
      WRITE (6,1130)
      I1TAB = LEO
      CALL TABPRT(BLANK,XE,LEE,10)

  140 IF(LRE.LT.LRO) GO TO 150
 1140 FORMAT(///1X98HTABULATION OF CHANNELS EMBRACED BY THE ORTHOGONALS
     *WHICH PASS THROUGH THE ABOVE POINTS, /ORTCHN/ =//4X26HLR
     *LE       LR-PREV)
      WRITE (6,1140)
      I1TAB = LRO
      CALL TABPRT(BLANK,LEDGE,LRE,LRD)

 1150 FORMAT(///1X17HSTREAMLINE TABLE-/17X32HJ        X2            SLCHN
     *      W/(I18,F12.6,6X,A6,F12.6,),)
  150 WRITE (6,1150) (J,X2(J),SLCHN(J),W(J),J=1,NJ)

 1190 FORMAT(///1X37HWAKE DISPLACEMENT THICKNESS, /WAKETB///11X19HX2W/S1
     *W           DST)
      WRITE (6,1190)
      I1TAB = LWO
      CALL TABPRT(BLANK,X2W,LWE,2)

 1180 FORMAT(///1X43HTABLE OF FLOW ADJUSTMENT STATIONS, /CADJWF///15X8HX
     *1F9X,3HX2F8X,4HX1BF8X,4HX1AF9X,3HS1F8X,4HNCHB8X,16HNCHA       JORDE
     *R)
      WRITE (6,1180)
      I1TAB = LFO
      CALL TABPRT(BLANK,X1F,LFE,NFCOLS)

 1160 FORMAT(///1X25HSTATION TABLE, /STATAB/ -)
      WRITE (6,1160)
      I1TAB = LO
      CALL TABPRT(BLANK,X1,LESTA,5)

C     PRINT OVERALL DATA
      CALL TABPRT(6HALLCOM,MACHA,20,8)
```

```
      IF( IBLB(1).NE.0 ) CALL TABPRT(5HBLBDY,IBLB,60,3)
      IF( LDE.EQ.0 ) GO TO 1321
      I1TAB = LDO
      CALL TABPRT(5HBLTAB,CHNAM,LDE,3)
 1321 CONTINUE

      IF(LESTA.LE.0) GO TO 900
      L      = LO
      LMAX   = LESTA
  180 OMITFK= .TRUE.
      LINES = 64
  190 MA     = MLB(L)
      MB     = MUB(L)
      CALL FHEAD(MB-MA+2)
      IF (LINES.EQ.(MB-MA+5)) WRITE (6,1200)
      WRITE (6,1202)
      DO 200 M=MA,MB
      CALL GETIX
      WRITE (6,1201) J,M,MU,MD,ISTAG, S1(M),S2(M),Z(M),R(M),PHI1(M),
     1          CURV(M),VM(M),B(M),RHS(M),DS2(M)
  200 CONTINUE
      L      = L+LNEXT(L)
      IF(L.LE.LMAX) GO TO 190
 1200 FORMAT(57X,16HFIELD TABLE DUMP/128H     J     M    MU    MD I    S1
     1     S2               Z               R            PHI1        CURV          V
     2M            B        RHS          DS2)
 1201 FORMAT (1X,I3,3I5,I2,2F11.6,2F12.6,F11.6,F12.7,2F11.3,2F10.5)
 1202 FORMAT(1H )

      IF( IGGO.EQ.2 ) RETURN
      LSTOP = 5
      GO TO (900,1977) , LSTOP
  900 RETURN
      END
```

```
*DECK REDBLK
      BLOCK DATA REDBLK
*REDBLK         REDINP BLOCK DATA                                    *REDBLK*
      COMMON /SPACER/ MAXLH,MAXLT,MAXLF,MAXLW
      COMMON /CLWOSV/ LWOSV
      COMMON /CTAPOS/  RESTRT,ENDBDT,STCFIL,K6SV
      LOGICAL          RESTRT,ENDBDT,STCFIL
      DATA MAXLH,MAXLT,MAXLF,MAXLW/400,200,200,200/
      END
```

```
*DECK DBSRT1
      SUBROUTINE DBSRT1( F,M,INTR1,INTR2,A,N,II )
*DBSRT1
C  DATE OF THIS VERSION - SEPTEMBER 20,1965
C  SINGLE PRECISION DOUBLE BACK SUBSTITUTION SUBROUTINE USED WITH
C     LRMDS1 SUBROUTINE TO SOLVE SIMULTANEOUS EQUATIONS
      DIMENSION F(II,1),A(II,II),INTR1(1)
      NN=N
      NM1=NN-1
      MM=M
      IF(INTR1(1)) 10,140,10
   10 IF(NN.LE.1) GO TO 40
      DO 30 K=1,NM1
      I1=INTR1(K+1)
      IF(I1) 15,30,15
   15 DO 20 J=1,MM
      X=F(K,J)
      F(K,J)=F(I1,J)
   20 F(I1,J)=X
   30 CONTINUE
   40 DO 90 J=1,MM
      DO 80 L=1,NN
      IF(F(L,J)) 50,80,50
   50 F(L,J)=F(L,J)/A(L,L)
      IF(L.EQ.NN) GO TO 80
      DO 70 I=L,NM1
      IF(A(I+1,L)) 60,70,60
   60 F(I+1,J)=F(I+1,J)-A(I+1,L)*F(L,J)
   70 CONTINUE
   80 CONTINUE
   90 CONTINUE
      IF(NN.LE.1) GO TO 140
  100 DO 130 J=1,MM
      IF(F(NM1+1,J)) 110,130,110
  110 DO 120 I=1,NM1
  120 F(I,J)=F(I,J)-A(I,NM1+1)*F(NM1+1,J)
  130 CONTINUE
      NM1=NM1-1
      IF(NM1) 100,140,100
  140 RETURN
      END
```

```
*DECK ISORT
      SUBROUTINE ISORT(X,Y,Z,B,LB,KGO)
CISORT*-- CDC VERSION *-MOVE COLUMN DATA TO ARRAYS
      COMMON /CBITS / BITS,BLANK
      DIMENSION X(1),Y(1),Z(1), B(1)
C     INPUT-
C     X,Y,Z       = NEW COLUMNS OF DATA
C     B           = LOCATION OF COLUMN DATA TO BE RELOCATED
C     LB          = B*COLUMN LENGTH

      K     = 1
      I     = 1
      GO TO ( 10,30 ) , KGO
   10 IF( B(I).EQ.BITS ) GO TO 20
      X(K)  = B(I)
      Y(K)  = B(I+1)
      Z(K)  = B(I+2)
   20 I     = I+3
      K     = K+1
      IF( I.LT.LB ) GO TO 10
      GO TO 50

   30 IF(B(I).EQ.BITS) GO TO 40
      X(K)  = B(I)
      Y(K)  = B(I+1)
   40 I     = I+2
      K     = K+1
      IF(I.LT.LB) GO TO 30
   50 RETURN
      END
```

```
*DECK LOOP
      SUBROUTINE LOOP(A,B,C,N)
*LOOP
C  THIS SUBROUTINE IS USED BY SUBROUTINE LRMDS1
      DIMENSION A(1),B(1)
      DO 10 I=1,N
   10 A(I)=A(I)+B(I)*C
      RETURN
      END
```

```
*DECK LRMDS1
      SUBROUTINE LRMDS1(A,N,INTR1,INTR2,DET,IFACTR,III)
*LRMDS1
C   DATE OF THIS VERSION -- SEPTEMBER 20,1965
C   SINGLE PRECISION LEFT RIGHT MATRIX DECOMPOSITION SUBROUTINE
C   DETERMINANT = DET*(2.0**IFACTR)
C      WHERE (.5) LESS THAN (ABS(DET)) LESS THAN OR EQUAL (1.0)
       DIMENSION A(1),INTR1(1)
       IDIM=III
       NN=N
       NBASE=(NN-1)*IDIM
       NTR=1
       IF(NN.LE.1) GO TO 30
       DO 25 K=2,NN
       INTR1(K)=0
       D=0.0
       M=K
       KM1=K-1
       L=KM1
       JSTOP=KM1+NBASE
       KBASE=(KM1-1)*IDIM
       KKM1=K+KBASE
       KK=KM1+KBASE
       ISTOP=NN+KBASE
       DO 6 I=KK,ISTOP
       B=A(I)
       IKBASE=I-KBASE
*
* MODIFICATION TO SELECT  THE PIVOT ELEMENT AS 1.0 IF PRESENT...
*
* DAVE FERGUSON       10/18/66
*
       IF(B.NE.1.) GO TO 70
       D=1.
       L=IKBASE
       M=IKBASE
       GO TO 80
    70 CONTINUE
*
*
       IF(ABS(B).LE.ABS(D) ) GO TO 3
       D=B
       L=IKBASE
     3 IF(B)4,6,4
     4 M=IKBASE
     6 CONTINUE
    80 CONTINUE
       KM=K-M
       KSTOP=M-KM1
       IF(D) 8,7,8
     7 NTR=0
       INTR2=KM1
       GO TO 60
     8 LKM1=L-KM1
       IF(LKM1) 10,17,10
    10 DO 11 J=KM1,JSTOP,IDIM
       LJ=J+LKM1
       X=A(J)
       A(J)=A(LJ)
    11 A(LJ)=X
       INTR1(K)=L
       NTR=-NTR
```

```
17 KK=KK+IDIM
   DO 22 I=KK,JSTOP,IDIM
   IF(A(I)) 19,22,19
19 A(I)=A(I)/D
   IF(KM) 20,20,22
20 Q=-A(I)
   CALL LOOP(A(I+1),A(KKM1),Q,KSTOP)
22 CONTINUE
25 CONTINUE
30 D=0.0
   KM1=NN
   KSTOP=NN+NBASE
   IF(A(KSTOP)) 40,7,40
40 IFAC=0
   D=1.0
   IDIM1=IDIM+1
   DO 55 K=1,KSTOP,IDIM1
   IF(ABS(A(K)).GE.1.0) GO TO 51
   D=D*2.0
   IFAC=IFAC-1
51 D=D*A(K)
52 IF(ABS(D)-1.0) 53,55,54
53 D=D*2.0
   IFAC=IFAC-1
   GO TO 52
54 D=D/2.0
   IFAC=IFAC+1
   IF(ABS(D).GT.1.0) GO TO 54
55 CONTINUE
   IFACTR=IFAC
   IF(NTR.EQ.1) GO TO 60
   D=-D
60 DET=D
   INTR1(1)=NTR
   RETURN
   END
```

```
*DECK STCNR
      OVERLAY(STC,1,1)
      PROGRAM STCNR
      CALL REDINP
      RETURN
      END
```

```
*DECK BFACES
      SUBROUTINE BFACES(X,Y,ANG,CURV,E,S,KA,KB)
*BFACES          BEAM FIT EVALUATION OF ANGLE, CURVATURE,     *BFACES*
C                E  AND  S
      DIMENSION X(10),Y(10),ANG(10),CURV(10),E(10),S(10)

C     INPUT-
C      X,Y     = COORDINATES
C      ANG     - ANGLE IN RADIANS  (IF MA=1)
C      ANG(1)= ESTIMATED ANGLE AT THE FIRST POINT (MA=0)
C      KA,KB = FIRST AND LAST INDEX OF VARIABLES  X,Y,ANG,CURV,E AND S
C      KD     - STORAGE INCREMENT OF  X,Y,ANG,CURV,E, AND S
C      KORDER= 0 IF ERROR1 IS TO BE CALLED WHEN PTS ARE OUT OF ORDER
C            = NON ZERO IF RETURN IS TO BE MADE FOR CORRECTIVE ACTION

C     OUTPUT-
C      ANG     - ANGLE IN RADIANS
C      CURV    - CURVATURE
C      E       - APPLIED FORCES = F/EI  (UNITS ARE 1./L**2)
C      S       = ARC LENGTH ALONG THE CURVE,  (L)
C      KORDER= INDEX OF 2ND OF ADJACENT OUT-OF-ORDER PTS, NOT=0 ON ENTRY

      COMMON /CBEAM/   MA,MB,KD,KORDER
      COMMON /ERASE / A(3),B(1),YPB(1),DA(1),ACHD(1),CHD(793)

      NK      = KB

      CALL BEAM(X(KA),Y(KA),ANG(KA),(KB-KA+KD)/KD)
      IF(KORDER.NE.0) GO TO 800

C      (K=KA)
       I       = 1
       K       = KA
       SK      = S(K)
       E(K)    = 6.*(B(I)+YPB(I))/(CHD(I)*CHD(I))
C      (K=KA,KB-1)
   60 CURV(K)= (4.*B(I)+2.*YPB(I))/(CHD(I)*(1.+1.5*B(I)*B(I)))
       IF(KA-K) 65,80,80
C      (K=KA+1,KB-1)
   65 E(K)    = 6.*((B(I)+YPB(I))/(CHD(I)*CHD(I))
     1           - (B(I-8)+YPB(I-8))/(CHD(I-8)*CHD(I-8)))
C      (K=KA+1,KB)
   70 SK      = SK + CHD(I-8)*(1.+(B(I-8)*B(I-8)-.5*B(I-8)*YPB(I-8)+
     1           YPB(I-8)*YPB(I-8))/15.)
       S(K)    = SK
       IF(K-NK) 80,90,90
   80 I       = I+8
       K       = K+KD
       IF(K-NK) 60,70,70

C      (K=KB)
   90 CURV(K)=(-2.*B(I-8)-4.*YPB(I-8))/(CHD(I-8)*(1.+1.5*YPB(I-8)*YPB(I-
     1           8)))
       E(K)    = -6.*(B(I-8)+YPB(I-8))/(CHD(I-8)*CHD(I-8))
       GO TO 900

C      OUT OF ORDER POINTS
  800 KORDER= KA+KORDER-KD
  900 RETURN

       END
```

```
*DECK ELLIP
      SUBROUTINE ELLIP(X1,Y1,ANG1,X2,Y2,ANG2,ALPHAD)
*ELLIP           ELLIP AND OTHER SMOOTH DUMMY SUBROUTINES
C  SUBROUTINE TO FIT AN ELLIPSE GIVEN TWO POINTS AND THE ORIENTATION

      ENTRY ELLIPT
C  SUBROUTINE TO FIT AN ELLIPSE WHOSE ORIGIN AND DIMENSION ARE GIVEN IN
C  A ROTATED AND TRANSLATED COORDINATE SYSTEM

      ENTRY XTRUNC
C  FUNCTION TO TRUNCATE XX TO AN EVEN MULTIPLE OF DX

      ENTRY ATDMR
C  SUBROUTINE FOR AUGMENTED TRIDIAGONAL MATRIX REDUCTION

      ENTRY BAD
C  SUBROUTINE TO DELETE BAD DATA BY ADJUSTING DATA LISTS


      ENTRY CUBER
C  SUBROUTINE TO CALCULATE YPP IN TERMS OF Y FOR CUBIC SPLINE EQUATIONS
C  WITH ARBITRARY END CONDITIONS

      ENTRY SMULTI
C  SUBROUTINE TO MULTIPLY TRIADIAGONAL AND SQUARE MATRIX

      ENTRY HYPTS
      ENTRY HYPER1
      ENTRY HYPER2
      RETURN
      END
```

```
*DECK RELOXY
      SUBROUTINE RELOXY(I1,I2, NPTS, IM1,IM2)
*RELOXY            RELOCATE X,Y,ANG,ANGD,CURV,S,FOK                  *RELOXY*

C     INPUT-
C      I1,I2 = INDEX RANGE OF SEGMENT DATA IN XA,YA-ARRAYS
C      NPTS  = NO OF PTS REQD FOR SEGMENT DEFINITION IN X,Y-ARRAYS
C      IM1   = INDEX OF FIRST POINT OF THE SEGMENT IN X,Y-ARRAYS
C      IM2   = INDEX OF LAST  POINT OF THE SEGMENT IN X,Y-ARRAYS
C      NIM   = LENGTH OF X,Y-ARRAYS
C      N     = SEGMENT INDEX

C     OUTPUT-
C      IM2   = INDEX OF LAST POINT IN RELOCATED X,Y-ARRAYS
C      RELOCATED X,Y,..-ARRAYS
C      ADJUSTED IMA,IMB INDEX LIMIT VALUES

      COMMON /CSEGME/ IA(10),IB(10),IMA(10),IMB(10),JTYPE(10),
     1                N,NSEG, NI,NIB
      COMMON /CDS2  / X(100),Y(100),ANG(100),ANGD(100),CURV(100),
     1                S(100),FOK(100),DEV(100),CURVB(100)
      COMMON /TROUBL/ ERR,ERRMAJ,INERR,PRERR
       LOGICAL        ERR,ERRMAJ,INERR,PRERR

      NADD  = NPTS - (I2-I1+1)
      IF    = IM2+1
      IT    = IF+NADD
      NMOVE = NIM-IM2
      IF(NADD.GE.0) NMOVE=-NMOVE
      NIM   = NIM+NADD
      IF(NIM.LE.100) GO TO 30
      ERR   = .TRUE.
      WRITE (6,1030)
      RETURN
 1030 FORMAT(/1X67HSORRY - THE NO. OF OUTPUT PTS, EXCEEDS THE ALLOCATED
     *STORAGE (200).)
   30 IF(NMOVE*NADD.EQ.0) GO TO 50
      CALL MOVE(3, X(IF),X(IT),NMOVE,1,
     1             Y(IF),Y(IT),NMOVE,1,
     2             ANG(IF),ANG(IT),NMOVE,1)
      CALL MOVE(3, ANGD(IF),ANGD(IT),NMOVE,1,
     4             CURV(IF),CURV(IT),NMOVE,1,
     5             S(IF),S(IT),NMOVE,1)
      CALL MOVE(3, FOK(IF),FOK(IT),NMOVE,1,
     7             DEV(IF),DEV(IT),NMOVE,1,
     8             CURVB(IF),CURVB(IT),NMOVE,1)
   50 IM2   = IM1 + NPTS-1
      IF(IM2.LT.IM1) GO TO 70
      DO 60 I=IM1,IM2
      DEV(I)= 0.
      CURVB(I)=0.
   60 FOK(I)= 0.
   70 IMB(N)= IM2
      NP1   = N+1
      IF(NP1.GT.NSEG) GO TO 900
      DO 80 NN=NP1,NSEG
      IMA(NN)=IMA(NN)+NADD
   80 IMB(NN)=IMB(NN)+NADD

  900 RETURN
      END
```

```
*DECK SERS1
      SUBROUTINE SERS1(X1,Y1, X2,Y2, A)
*SERS1*           NACA SERIES-1 COWL CONTOUR                          *SERS1*

C     INPUT-
C      X1,Y1  = COORDINATES AT HIGHLITE
C      X2,Y2  = COORDINATES ON COWL SURFACE
C      A      = X/X LIMIT POINT

C     OUTPUT-
C      CALC VALUES OF X,Y,ANG,ANGD,CURV,S

      COMMON /CBEND / NBC(2),ANGE(2),CURVE(2),FEND(2)
      COMMON /CPI   / PI,TWOPI,PIQ2,PIQ4,TODEG,TORAD
      COMMON /CSEQME/ IA(10),IB(10),IMA(10),IMB(10),JTYPE(10),
     1                N,NSEG, NI,NIM
      COMMON /CDS2  / X(100),Y(100),ANG(100),ANGD(100),CURV(100),
     1                S(100),FQK(100),DEV(100),CURVB(100)
       DIMENSION      ANGB(100)
       EQUIVALENCE    (ANGB,CURVB)

      DIMENSION       XS1(40),YS1(40),TS1(40)

      DATA XS1/
     *0.,.000106,.0003062,.0006461,.0012998,.0020031,.0039664,.006002,
     *.008,.01,.015,.02,.025,.03,.035,.04,
     *.045,.05,.06,.07,.08,.09,.1,.12,
     *.14,.16,.18,.20,.22,.25,.3,.35,
     *.4,.45,.5,.6,.7,.8,.9,1.0/
      DATA YS1/
     *0.,.0112,.019,.0275,.0388,.047969,.066707,.08117,
     *.093118,.10386,.127271,.147458,.165786,.182977,.199304,.214829,
     *.229594,.243677,.270135,.29478,.318041,.340196,.361381,.40087,
     *.43654,.468883,.498788,.526959,.553714,.591484,.648994,.700757,
     *.74746,.789479,.827209,.89087,.939554,.973716,.993649,1./
      DATA TS1/
     *0.,52.52592,80.79679,21.04343,14.69820,
     *11.71671,7.996274,6.397164,5.618328,5.133687,
     *4.308968,3.821510,3.533277,3.342515,3.183152,
     *3.029897,2.884790,2.755270,2.545330,2.388930,
     *2.268497,2.165982,2.068093,1.875127,1.697514,
     *1.552614,1.446208,1.368108,1.303797,1.217213,
     *1.090491,.981545,.885102,.797348,.715438,
     *.560407,.412448,.269017,.13063,0./

C     DETERMINE CUT-OFF POINT, NPTS
      IF(.05.LE.A .AND. A.LE.1.) GO TO 50
      WRITE (6,1050) A
      CALL ERROR1
   50 DO 60 K=17,40
      IF(XS1(K).GT.A) GO TO 70
   60 NPTS   = K

C     RELOCATE ARRAYS
   70 I1     = IA(N)
      I2     = IB(N)
      IM1    = IMA(N)
      IM2    = IMB(N)
      CALL RELOXY(I1,I2, NPTS, IM1,IM2)
      XR     = X2-X1
      YR     = Y2-Y1
      AR     = YR/XR
```

```
      K       = 1
      DO 120 I=IM1,IM2
      X(I)   = X1+XR*XS1(K)
      Y(I)   = Y1+YR*YS1(K)
      IF(I.EQ.IM1) GO TO 115
      ANG(I)= ATAN(AR*TS1(K))
      GO TO 118
  115 ANG(I)=PIO2
  118 ANGD(I)=ANG(I)*TODEG
  120 K       = K+1

      NBC(1)= 1
      NBC(2)= 1
      ANGE(1)=ANGD(IM1)
      ANGE(2)=ANGD(IM2)
      ANGB(IM1)=ANG(IM1)
      CALL BFACES(X,Y,ANGB,CURV,FQK,S, IM1,IM2)

      CALL FHEAD(51)
      WRITE (6,1150) X1,Y1,X2,Y2,A
      K       = 1
      DO 160 I=IM1,IM2
      ANGB(I)=ANGB(I)*TODEG
      WRITE (6,1160)
     * XS1(K),YS1(K),X(I),Y(I),ANGD(I),ANGB(I),CURV(I),S(I)
  160 K       = K+1
      CALL MOVE(1,CURV(IM1),CURVB(IM1),K-1,1)
      RETURN

 1050 FORMAT(/1X70H*** INPUT ERROR, PARAMETER A DOES NOT SATISFY  .05-A-
     *1.0 CRITERIA,   A=F6.3,)
 1150 FORMAT(/22X,30H* NACA SERIES-1 COWL CONTOUR *//4X16HINPUT DATA,   X
     *1=F9.5,3X3HY1=F9.5,/17X3HX2=F9.5,3X3HY2=F9.5,3X2HA=F6.3,///4X16HCO
     *ORDINATE DATA-//71X,29H-----  BEAM CALCULATED  -----/10X3HX/X7X,3H
     *Y/Y14X,1HZ14X,1HR9X,35HANGD          ANGB       CURV        S)
 1160 FORMAT(7X,F8.6,F10.5,F16.5,F15.5,F11.3,F12.3,F11.6,F10.5,)
      END
```

```
*DECK SMOINP
      SUBROUTINE SMOINP
*SMOINP          INPUT/OUTPUT AND SPECIAL CONTOUR ROUTINE     *SMOINP*
      COMMON             PROGM(8),PROGSV,FILIN,FILOT,REFS(5)
       LOGICAL                           FILIN,FILOT
      COMMON /ADAM01/ NAME(6),ADDRES(6),TITLE(6),IDENT(6)
      COMMON /CALCPT/ DX,XMOD
      COMMON /CBITS / BITS,BLANK
      COMMON /CELLPT/ DZETA
      COMMON /CLINES/ LINES,OMITFK,PTITLE(6)
       LOGICAL                 OMITFK
      COMMON /CNTRL / K5(1),STA(2),INCLUD(2),DELETE(2),INSERT,CARRY
       LOGICAL                                                CARRY
      EQUIVALENCE        (BDY,STA)
      COMMON /CPI    / PI,TWOPI,PIO2,PIO4,TODEG,TORAD
      COMMON /CSEGME/ IA(10),IB(10),IMA(10),IMB(10),JTYPE(10),
     1                N,NSEG, NII,NIM
       EQUIVALENCE       (NI,NII)
      COMMON /CSMOOA/ DEVA(20), FENDA(20),ANGA(20),CURVA(20), NARB
      COMMON /CSMOOB/ XA(100),YA(100),DEVI(100)
       DIMENSION         ZA(100),RA(100)
       EQUIVALENCE       (ZA,XA),(RA,YA)
      COMMON /CDS2   / X(100),Y(100),ANG(100),ANGD(100),CURV(100),
     1                S(100),FQK(100),DEV(100),CURVB(100)
       DIMENSION         DUM(100)
       EQUIVALENCE       (DUM,CURVB)
       DIMENSION         Z(100),R(100)
       EQUIVALENCE       (Z,X),(R,Y)
      COMMON /TROUBL/ ERR,ERRMAJ,INERR,PRERR
       LOGICAL           ERR,ERRMAJ,INERR,PRERR, ERRCAS
       EQUIVALENCE       (ERRCAS,INERR)

      LOGICAL            UPPER

      DIMENSION          CNAMES(4)
      DATA CNAMES/990.,992.,993.,991./

C*** DEFINE THE NUMBER OF SEGMENTS AND THE INDEX LIMITS
C     NSEG  = NUMBER OF SEGMENTS
C     N     = SEGMENT INDEX
C     IA(N),IB(N)=LIMITS OF SEGMENT IN THE XA,YA LISTS
C     TYPE(N)=TYPE OF SEGMENT
   45 N      = 1
      I      = 1
      IJUNCT= 1
      GO TO 55
   50 IF(XA(I).EQ.XA(I-1) .AND. YA(I).EQ.YA(I-1)) GO TO 70
   55 IF(I-NI) 60,155,155
   60 DO 65 J=1,4
   65 IF(XA(I).EQ.CNAMES(J)) GO TO 75
      IF(I.EQ.IJUNCT) GO TO 70
      I      = I+1
      GO TO 50

C     CONTOUR JUNCTURE
   70 J      = 1
   75 JTYPE(N)=J
      IA(N) = I
      N      = N+1
      GO TO (110,120,130,140),J

C     ARBITRARY CURVE
```

```
  110 IB(N-1)=0
      I      = I+1
      GO TO 50

C     ELLIPSE
  120 IB(N-1)=I+3
      IF((I+2.EQ.NI) .OR. (XA(I+2).EQ.XA(I+3) .AND. YA(I+2).EQ.YA(I+3)))
     +IB(N-1)=I+2
      GO TO 150

C     SPIRAL
  130 IB(N-1)=I+3
      GO TO 150

C     SERIES 1
  140 IB(N-1)=I+2
  150 I      = IB(N-1)+1
      IJUNCT= I
      GO TO 55

C     END OF INPUT DATA, FILL ZERO IB(N)
  155 NSEG   = N-1
      IB(N-1)=NI
      DO 160 N=1,NSEG
  160 IF(IB(N).EQ.0) IB(N)=IA(N+1)-1
      RETURN

C*** FIT THE SPECIAL CONTOURS
      ENTRY CONTRS
      DO 195 N=1,NSEG
      IMA(N)= IA(N)
  195 IMB(N)= IB(N)
      NIM    = IB(NSEG)
      N      = 1
  200 J      = JTYPE(N)
      IF(J.LE.1) GO TO 790
      OMITFK= .TRUE.
      CALL FHEAD(6)
      WRITE (6,1202) N,BDY
      I      = IA(N)
      I2     = IB(N)
      IM     = IMA(N)
      IM2    = IMB(N)
      X1     = XA(I+1)
      Y1     = YA(I+1)
      IF(N.LE.1) GO TO 206
      X1     = X(IM-1)
      Y1     = Y(IM-1)
  206 X2     = XA(I+2)
      Y2     = YA(I+2)
      IF(N.EQ.NSEG .OR. JTYPE(N+1).NE.1) GO TO 220
      X2     = X(IM2+1)
      Y2     = Y(IM2+1)
  220 IF(IM.LE.1) GO TO 222
      ANG1   = ANGD(IM-1)
  222 IF((I2-I).EQ.3 .AND. (XA(I+3).NE.BITS.AND.XA(I+3).NE.999.))
     *            ANG1=XA(I+3)
      IF(IM2.GE.NIM) GO TO 224
      ANG2   = ANGD(IM2+1)
  224 IF((I2-I).EQ.3 .AND. (YA(I+3).NE.BITS .AND. YA(I+3).NE.999.))
     *            ANG2=YA(I+3)
```

```
      IF(J-3) 250,300,400
C     FIT THE ELLIPSE
  250 CALL ELLIP(X1,Y1,ANG1, X2,Y2,ANG2, YA(I))
      IF(ERR) GO TO 790
      DZETA = 5.*TORAD
      CALL ELLIPT
      GO TO 790
C     FIT THE HYPERBOLIC SPIRAL
  300 IF(YA(I).EQ.2.) GO TO 320
      CALL HYPER1(X1,Y1,ANG1, X2,Y2,ANG2)
      GO TO 350
  320 CURV1 = YA(I+3)
      CALL HYPER2(X1,Y1,ANG1,CURV1, X2,Y2)
  350 IF(ERR) GO TO 790
      CALL HYPTS
      GO TO 790
C     SERIES 1 COWL LIP.
  400 CALL SERS1(X1,Y1, X2,Y2, YA(I))
C     INDEX TO THE NEXT SEGMENT
  790 IF(ERR) ERRCAS=.TRUE.
      ERR    = .FALSE.
      N      = N+1
      IF(N.LE.NSEG) GO TO 200
C     IF ERR HAS BEEN ENCOUNTERED, DO NOT WRITE OUTPUT FILE
      IF(.NOT.ERRCAS) GO TO 800
      ERRMAJ= .TRUE.
      ERRCAS= .FALSE.
      RETURN
C     MAKE THE CURVALINEAR DISTANCE CONTINUOUS
  800 DS     = 0.
      DO 805 I=2,NIM
      IF(S(I).EQ.0.) DS=S(I-1)
  805 S(I)   = S(I)+DS
C*** WRITE TOTAL COMPUTED DATA FOR THE BOUNDARY
      OMITFK= .TRUE.
      CALL FHEAD(NIM+4)
      WRITE (6,1800) (I,S(I),X(I),Y(I),ANGD(I),CURVB(I),FQK(I),I=1,NIM)
 1800 FORMAT(/21X24HCONSOLIDATED OUTPUT DATA//4X59HI        S         X,Z
     *         Y,R       ANGD       CURV        FQK/40X7HDEGREES/(2X,I3,0PF10,5
     *,2F11.5,F9.3,F10.6,F10.5,).)

      RETURN

 1040 FORMAT(/1X59H***  ERROR - NUMBER OF INPUT POINTS (XA,YA) IS LESS T
     *HAN 2.)
 1042 FORMAT(/1X34HINPUT TAPE RETRIEVAL INFORMATION -//2X7HFOUND =L3,)
 1202 FORMAT(/8H SEGMENT,I3,9H  OF BDY=,A6/26H --------------------------
     *)
      END
```

```
*DECK SMOO
      SUBROUTINE SMOO
*SMOO--         ANGLE, CURVATURE AND ARC LENGTH                    *SMOO*
C               OF A SMOOTH CURVE PASSING CLOSE TO GIVEN POINTS
C               THE SMOOTHING OPTION HAS NOT BEEN INCLUDED.  INSTEAD, A
C               CURVE IS FITTED TO THE GIVEN X,Y POINTS.

C     INPUT-
C NA  MEANS NOT AVAILABLE IN THIS VERSION
C     IA,IB = RANGE OF INDEX IN LISTS XA,YA,DEVI,DEV,X,Y,ANG,CURV,E,S
C     XA    = LIST OF INPUT X
C     YA    = LIST OF INPUT Y
C NA  DEVI  = LIST OF POINT MOVEMENT PARAMETERS
C NA  TORQ1 = TORSIONAL SPRING COMPLIANCE - FIRST END
C NA  TORQN = TORSIONAL SPRING COMPLIANCE - SECOND END
C     NBC(L)= BOUNDARY CONDITION INDICATOR FOR FIRST(L=1) AND SECOND(L=2
C           = 0, 1, OR 2
C     ANGE(L)= ANGLE IN DEGREES, IF NBC(L)=1
C     CURVE(L)=CURVATURE, IF NBC(L)=2
C     FEND(L)=RATIO OF SHEAR FORCE.   END/NEXT TO END INTERVAL, IF NBC(L

C     NOTES-
C     THE UNITS OF XA,YA,DEVI,TORQ1 AND TORQN MUST BE THE SAME,
C     FOR EXAMPE, INCHES.  DEVI IS PROPORTIONAL TO THE CUBE ROOT OF
C     THE SPRING COMPLIANCES.  TORQS ARE DIRECTLYPROPORTIONALTOTHE
C     END TORSIONAL SPRING COMPLIANCES.  LARGER VALUES OF DEVI YEILD
C     LOWER APPLIED FORCES (AND GREATER DEVIATIONS), LARGER VALUES OF
C     TORQ YIELD LOWER APPLIED END MOMENTS.

C     OUTPUT BASED ON ADJUSTED POINTS-
C NA  DEV=V = DEVIATION FROM THE INPUT POINTS IN THE NORMAL DIRECTION,IN
C     X,Y   = ADJUSTED COORDINATES
C NA  ANG   = ANGLE IN RADIANS
C NA  ANGD  = ANGLE IN DEGREES
C NA  CURV  = CURVATURE, 1/IN
C NA  FQEI  = APPLIED FORCES, DELTA Y***, 1/IN2
C NA  S     = LENGTH ALONG THE CURVE, IN
C NA  ED    = ENERGY OF EQUIVALENT SPRINGS UNDER DEFLECTION DEV, 1/IN
C NA  ET    = SPRING ENERGIES, 1/IN
C NA  RMSDEV= ROOT MEAN SQUARE DEVIATION OF POINTS WITH DEVI,NE,0
C NA  RMSF  = ROOT MEAN SQUARE VALUE OF F/EI, 1/IN2
C NA  RMSF1 = ROOT MEAN SQUARE VALUE OF F/EI FOR UNADJUSTED BEAM

      COMMON /CCURV / NN,IDIM,G(2)
      COMMON /CB    / A(2)
       DIMENSION      U(2)
       EQUIVALENCE    (U,G)
      DIMENSION       V(100),W(100)
       EQUIVALENCE    (W,V)
      COMMON /CBEND / NBC(2),ANGE(2),CURVE(2),FEND(2)
       EQUIVALENCE    (NBC1,NBC),(NBC2,NBC(2))
      COMMON /CCUBE / NBCS(2),SAVS(4),FENDS(2)
      COMMON /CSEGRE/ IIA(10),IIB(10),IMA(10),IMB(10),JTYPE(10),
     1                N,NSEG,NI,NIM
      COMMON /CSMOOB/ XA(100),YA(100),DEVI(100)
      COMMON /CDS2  / X(100),Y(100),ANG(100),ANGD(100),CURV(100),
     1                S(100),FQK(100),DEV(100),CURVB(100)
       DIMENSION      E(100)
       EQUIVALENCE    (E,FQK)
      COMMON /CSMOOD/ SGAMMA,SZETA1,SZETAN
      COMMON /ERASE / H(8,100)
       DIMENSION      GHD(8,99), G1(100),GN(100), INTER1(100)
```

```
      EQUIVALENCE    (CHD,H(8,1)), (INTER1,G1,H(1,1)), (GN,H(1,14))
      COMMON /CSMODE/ GAMMA(100)
      COMMON /TROUBL/ ERR,ERRMAJ,INERR,PRERR
      LOGICAL         ERR,ERRMAJ,INERR,PRERR

      DIMENSION       ENDPAR(3)
      DATA ENDPAR/5HFENDA,4HANGA,5HCURVA/

C     WRITE OUT END CONDITIONS
      ANGE(1)=FEND(1)
      ANGE(2)=FEND(2)
      CURVE(1)=FEND(1)
      CURVE(2)=FEND(2)
      WRITE (6,1020) ENDPAR(NBC1+1),FEND(1), ENDPAR(NBC2+1),FEND(2)
 1020 FORMAT(10X,47H* A CURVE HAS BEEN FITTED TO GIVEN X,Y POINTS *//
     1 6X,18HEND CONDITIONS -  , A5,4H(1)=,F9.5, 10X,A5,4H(2)=,F9.5)
     *H(2)=F9.5,)

      IA     = IIA(N)
      IB     = IIB(N)
      NPTS   = IB-IA+1
      IAB    = NPTS

C     CALC FORCES, F/EI, APPLIED TO THE BEAM WHICH PASSES THROUGH POINTS
      CALL BFACES(XA,YA,ANG,CURVB,E,S,IA,IB)
      CALL MOVE(2,XA(IA),X(IA),IAB,1, YA(IA),Y(IA),IAB,1)
      I      = IA
      K      = 1
  405 ANGD(I)=ANG(I)*57.29578
  415 K      = K+1
      I      = I+1
      IF(NPTS-K) 430,405,405
C   SMOOTHING LOGIC HAS BEEN REMOVED
  430 WRITE (6,1100)
      WRITE (6,1110) (XA(I),YA(I),DEVI(I),DEV(I),X(I),Y(I),ANGD(I),
     1               CURVB(I),FOK(I),S(I),I=IA,IB)
 1100 FORMAT(72X,10X,15HAPPLIED      ARC/6X17HINPUT COORDINATES17X,20HADJ
     *USTED COORDINATES22X,17HFORCES      LENGTH/7X89HXA,ZA        YA,RA
     * DEVI      DEV        X,Z            Y,R         ANGD        CURV        FOK
     *     S/33X,37H*1000                            DEGREES)
 1110 FORMAT(2X,2F11.5,F7.2,3PF7.2,0P2F11.5,F9.3,F10.6,2F10.5,)
      RETURN

      END
```

```
*DECK SMOTH
      SUBROUTINE SMOTH
*SMOOTH          MAIN PROGRAM FOR SMOOTH                                 *SMOOTH*
C     READ INPUT; DETERMINE NUMBER AND TYPE OF SEGMENTS
      CALL SMOINP
C     SMOOTH ARBITRARY SEGMENTS
      CALL SMOXEQ
C     CALC SPECIAL-CONTOUR SEGMENTS, WRITE OUTPUT
      CALL CONTRS
      RETURN
      END
```

```
*DECK SMOEXQ
      SUBROUTINE SMOXEQ
*SMOXEQ          ARBITRARY SEGMENT SMOOTHING                          *SMOXEQ*

      COMMON /CBITS / BITS,BLANK
      COMMON /CBEND / NBC(2),ANGE(2),CURVE(2),FEND(2)
      COMMON /CNTRL / K5(1),STA(2),INCLUD(2),DELETE(2),INSERT,CARRY
      EQUIVALENCE      (BDY,STA)
      COMMON /CSEGME/ IA(10),IB(10),IMA(10),IMB(10),JTYPE(10),
     1                N,NSEG, NII,NIM
      EQUIVALENCE      (NI,NII)
      COMMON /CSMOOA/ DEVA(20), FENDA(20),ANGA(20),CURVA(20), NARB
      COMMON /CSMOOB/ XA(100),YA(100),DEVI(100)
      COMMON /CDS2  / X(100),Y(100),ANG(100),ANGD(100),CURV(100),
     1                S(100),FOK(100),DEV(100),CURVB(100)
      COMMON /CLINES/ LINES,OMITFK,PTITLE(6)
      LOGICAL               OMITFK
      COMMON /TROUBL/ ERR,ERRMAJ,INERR,PRERR
      LOGICAL          ERR,ERRMAJ,INERR,PRERR
      LOGICAL          ERRCAS
      EQUIVALENCE      (ERRCAS,INERR)
      LOGICAL          DONE

C*** SMOOTH ARBITRARY CURVES
      NSWEEP= 1
  170 DONE  = .TRUE.
      ANGREF= 0.
      N     = 1
      NARB  = 1
  175 IF(JTYPE(N)-1) 189,176,190
  176 I     = IA(N)
      I2    = IB(N)
C       END CONDITIONS
      DEVI(I)=0.
      DEVI(I2)=0.
      FEND(1)=0.
      FEND(2)=0.
      NBC(1)= 0
      NBC(2)= 0
      L     = 0
  180 LL    = NARB*20+L
      IF(FENDA(LL).EQ.BITS) GO TO 181
      NBC(1)= L
      FEND(1)=FENDA(LL)
  181 IF(FENDA(LL+1).EQ.BITS) GO TO 182
      NBC(2)= L
      FEND(2)=FENDA(LL+1)
  182 L      = L+1
      IF(L.LE.2) GO TO 180
C       CHECK FOR UNDEFINED END CONDITIONS
C        END-1
       IF(FEND(1).NE.999.) GO TO 184
       IF(N.EQ.1) GO TO 187
       IF(JTYPE(N-1).GE.0) GO TO 187
       IF(NBC(1).EQ.1) FEND(1)=ANGD(I-1)
       IF(NBC(1).EQ.2) FEND(1)=CURV(I-1)
C        END-2
  184  IF(FEND(2).NE.999.) GO TO 186
       IF(N.GE NSEG).GO TO 200
       IF(JTYPE(N+1).GE.0) GO TO 187
       IF(NBC(2).EQ.1) FEND(2)=ANGD(I2+1)
       IF(NBC(2).EQ.2) FEND(2)=CURV(I2+1)
```

```
  186 IF(DEVA(NARB).NE.BITS) DEVI(I)=DEVA(NARB)
      IF(DEVA(NARB+1).NE.BITS) DEVI(I2)=DEVA(NARB+1)
      OMITFK= .TRUE.
      CALL FHEAD(17+I2-I)
      WRITE (6,1186) N,BDY
      S(I)  = 0.
      ANG(I)= ANGREF
      CALL SMOO
      JTYPE(N)=-1
      I2     = IB(N)
      ANGREF=ANG(I2)
      GO TO 188
  187 DONE   = .FALSE.
  188 IF(ERR) ERRCAS=.TRUE.
      ERR    = .FALSE.
  189 NARB   = NARB+2
  190 N      = N+1
      IF(N.LE.NSEG) GO TO 175

C     RETURN TO  170  TO LOOP THROUGH SEGMENTS AGAIN
C      TO PICK UP THOSE WHICH HAD UNDEFINED END CONDITIONS
      IF(DONE) RETURN
      NSWEEP= NSWEEP+1
      IF(NSWEEP.LE.10) GO TO 170
  200 WRITE (6,1200)
      ERRCAS=.TRUE.
      RETURN

 1186 FORMAT(/8H SEGMENT,I3,9H  OF BDY=,A6/26H -------------------------
     *)
 1200 FORMAT(1X50H***  ANGA,CURVA = 999  END OPTION USED INCORRECTLY)
      END
```

```
*DECK RBD
      SUBROUTINE RBD
*RBD---         READ IN BOUNDARY DATA                                 *RBD*

C     INPUT-
C      ENDBDT= END OF BDY/STC TAPE RECORDS, T OR F
C      ENDCRD= END OF ALL STC CARD INPUT, T OR F
C      K6SV  = VALUE OF KEY(6) OF LAST RECORD READ FROM TAPE
C      RESTRT= RESTART (WITH EXISTING TABLES) IS TRUE ONLY
C              IF CARD BDY-DATA HAS NOT YET BEEN ENCOUNTERED
C      STCFIL= T IF A STC-SUBFILE EXISTS ON TAPE=ORGF,
C     OUTPUT-
C      ENDBDT=
C      K6SV  =
C      RESTRT=

       INTEGER          REFS,BDY,CHN
C
C     BOUNDARY TABLE
C      INDEX- LB=LBDO,LBDE
C      LBNEXT= INCREMENT TO NEXT BOUNDARY
C      LBZ1  = INCREMENT TO THE FIRST BOUNDARY POINT (=0 BEFORE COALLATIO
C      CHNAME= CHANNEL WITH WHICH THE BOUNDARY DATA IS ASSOCIATED
C      UP    = T OR F FOR UPPER OR LOWER BOUNDARY
C      LEDEX = RELATIVE INDEX OF L.E. PCINT WHEN LOWER AND UPPER SURFACE
C              CONTOURS ARE CONNECTED
C      BDNAME,LBA,LBB=NAME AND INDEX LIMITS OF SPECIFIC BOUNDARY
C                     DATA WHEN BOUNDARIES ARE COALLATED
       COMMON /CHDATA/ BDT(1),LBNEXT(1),LBZ1(1),
     1                 CHNAME(1),UP(1),LEDEX(1),
     2                 ZBT(1),RBT(1),ANGBT(42)
        LOGICAL        UP
        INTEGER BDT,CHNAME,BDNAME
        DIMENSION      BDNAME(1),LBA(1),LBB(1)
        EQUIVALENCE    (BDNAME,ZBT), (LBA,RBT), (LBB,ANGBT)
C
       COMMON /BCOMMN/ PROGM(8),PROGSV,FILIN,FILOT
        LOGICAL                        FILIN,FILOT

       COMMON /ALLCOM/ MACHA,PSA,TSA,PTA,TTA, AXIA,RGA,GAMA,
     1                 MACHC,PSC,TSC,PTC,TTC, AXIC,RGC,GAMC,
     2                 DAXIT,SCALEA,TTE,CHOTST
        REAL           MACHA(1),MACHC
        LOGICAL        AXIA,AXIC,CHOTST
       COMMON /IXORIG/ LHO,LHE, LBDO,LBDE, LTO,LTE, LWO,LWE, LFO,LFE,
     *                 LO,LESTA,  LDUM(8),
     *                 MO,NM, NJ,NFCOLS, MAXNJ,MAXOL,MAXNM,MAXLE,
     *                 LEO,LEE, LRO,LRE,LRD
        DIMENSION      LIMITS(24)
        EQUIVALENCE    (LIMITS,LHO)

       COMMON /ADAM02/ ENDJOB,NUMPLT,PLOTED,ENDCRD
        LOGICAL        ENDJOB,        PLOTED,ENDCRD
       COMMON /CBITS / BITS,BLANK
       COMMON /CLINES/ LINES,OMITFK,PTITLE(6)
        LOGICAL             OMITFK
       COMMON /CNTRL / K5,BDY(6),INSERT,CARRY,CHN
        EQUIVALENCE    (BDY,IBDY)
       COMMON /CPI   / PI,TWOPI,PIO2,PIO4,TODEG,TORAD
       COMMON /CREDIN/ ZTRANS,RTRANS,ROTATE,ZPIVOT,RPIVOT,SCALE,NB,TAB(9)
        EQUIVALENCE    (XTRANS,ZTRANS),(YTRANS,RTRANS),(XPIVOT,ZPIVOT),
     1                 (YPIVOT,RPIVOT)
```

```
      COMMON /CTAPOS/ RESTRT,ENDBDT,STCFIL,K6SV
       LOGICAL         RESTRT,ENDBDT,STCFIL
      COMMON /ERASE /  B(800)
      COMMON /SPACBR/ MAXLH,MAXLT,MAXLF,MAXLW
      COMMON /TROUBL/ ERR,ERRMAJ,INERR,PRERR
       LOGICAL         ERR,ERRMAJ,INERR,PRERR

C     SMOOTH COMMONS
      COMMON /ADAM01/ NAME(6),ADDRES(6),TITLE(6),IDENT(6)
      COMMON /CALCRT/ DX,XMOD
      COMMON /CELLPT / DZETA
      COMMON /CSEGME/ IA(10),IB(10),IMA(10),IMB(10),JTYPE(10),N,NSEG,
     1                NII,NIM
       EQUIVALENCE (NI,NII)
      COMMON /CSMOOA/ DEVA(20),FENDA(20),ANGA(20),CURVA(20),NARB
      COMMON /CSMOOB/ XA(100),YA(100),DEVI(100)
       DIMENSION      ZA(100),RA(100)
       EQUIVALENCE    (ZA,XA),(RA,YA)
      COMMON /CDS2  / X(100),Y(100),ANG(100),ANGD(100),CURV(100),S(100),
     1                FQK(100),DEV(100),CURVB(100)
       DIMENSION      Z(100),R(100),DUM(100)
       EQUIVALENCE    (Z,X),(R,Y),(DUM,CURVB)

      COMMON /BLBDY / BLB(60)
      DIMENSION IBLB(60)
      EQUIVALENCE (IBLB,BLB)
      LOGICAL BL
      DATA LBLB/1/

      LOGICAL DATAIN,ENDBDC,UPPER,ZRONLY

      DATA KBDY/3HBDY/, KHIGH/6H      /

      NAMELIST /A/          B,          NB,        TAB,     DBLPTS,     ZRONLY,
     1        BDY,        CHN,      UPPER,        X,Z,        Y,R,       ANGD,
     2     ROTATE,     ZPIVOT,     RPIVOT,     ZTRANS,     RTRANS,      SCALE,
     3       FLIP,     XPIVOT,     YPIVOT,     XTRANS,     YTRANS,        DUM
     4,     IDENT,         DX,       XMOD,       DEVA,      FENDA,       ANGA,
     5      CURVA,      ZA,XA,      RA,YA,       DEVI,        NII,        DEV,
     6        ANG,       CURV,      CURVB,        FQK,          S,        NIM,
     7     UPPER
     *   ,CAPX1,BL

C     DEFINTE DOUBLE POINT TOLERANCE. DPTOL
      DPTOL = 1.E-5

C     INITIALIZE
C     ENDBDC= END OF BDY CARD INPUT, T OR F
      ENDBDC= .FALSE.
      IF(K5.NE.KBDY .OR. ENDCRD) ENDBDC=.TRUE.
   15 DATAIN= .FALSE.
      DBLPTS= .01
      JFOUND= 0
      CAPX1 = 0.
      BL    = .FALSE.
C     READ BDY INPUT CARDS
   35 IF( ENDBDC ) GO TO 40
      FLIP  = 1.
      ROTATE= 0.
      ZPIVOT= 0.
      RPIVOT= 0.
```

```
      SCALE = SCALEA
      ZTRANS= 0.
      RTRANS= 0.
      ZRONLY= .FALSE.
      CALL SETM(1,-1, DEVI,100)
      CALL SETM(3,BITS,XA,200,DEVA,80,B,300)
      CALL SETM(1,BITS,X,200)
      READ  (5,A)
      IF(ZRONLY) CALL ISORT(XA,YA,DUM,B,200,2)
      IF( .NOT.ZRONLY ) CALL ISORT(X,Y,ANGD,B,300,1)
      IF(INERR) ERRMAJ=.TRUE.
      DATAIN= .TRUE.
      RESTRT= .FALSE.

C     COUNT THE LENGTH OF THE  Z-LIST
   40 IF(.NOT.DATAIN) GO TO 900
      IF( JFOUND .EQ.1 ) GO TO 43
      NI     = 0
      DO 41 I=1,100
      IF(XA(I).EQ.BITS) GO TO 42
   41 NI     = I
   42 IF(NI .EQ. 0) GO TO 43
      LINES = 64
      CALL SMOTH
      JFOUND= 1
   43 NZ     = 0
      DO 45 I=1,100
      IF(Z(I).EQ.BITS) GO TO 50
   45 NZ     = I
   50 IF(NZ-2) 55,100,100
   55 WRITE (6,1055) BDY(1)
      ERRMAJ= .TRUE.
      RETURN

C     DELETE DOUBLE POINTS FROM SMOOTH BOUNDARY RECORDS
  100 OMITFK= .TRUE.
      CALL FHEAD(NZ+10)
      WRITE (6,1090) (BDY,CHN,UPPER,BL
      IF(JFOUND.NE.1 .OR. DBLPTS.EQ.0. .OR. NZ.LE.2) GO TO 150
      WRITE (6,1100) DBLPTS,DBLPTS
      I      = 1
  110 I      = I+1
      IF(I.GT.NZ) GO TO 150
      IF(ABS(Z(I)-Z(I-1)).GE.DPTOL .OR.
     1   ABS(R(I)-R(I-1)).GE.DPTOL) GO TO 110
      ANGDIF= ABS(ANGD(I)-ANGD(I-1))
      IF (ANGDIF.GE.DBLPTS) GO TO 110
      NMOVE = NZ-I
      ANGSV = .5*(ANGD(I)+ANGD(I-1))
      IF(ANGD(I)*ANGD(I-1).EQ.0. .AND. ANGDIF.LE..0005) ANGSV=0.
      ANGD(I-1)=ANGSV
      CALL MOVE(3, Z(I+1),Z(I),NMOVE,1,
     1             R(I+1),R(I),NMOVE,1,
     2             ANGD(I+1),ANGD(I),NMOVE,1)
      NZ     = NZ-1
      GO TO 110

C     CALCULATE CURVATURES FOR PRINTOUT
  150 I      = 1
      CURV(1)=0.0
  155 CURVB(I)=BITS
```

```
      CURV(I+1)=CURV(I)
      DX     = Z(I+1)-Z(I)
      DY     = R(I+1)-R(I)
      CHD    = SQRT(DX*DX+DY*DY)
      IF(CHD.LT..00001) GO TO 160
      ACHD   = ATAN3(DY,DX,ANGD(I)*TORAD)
      YPA    = ANGD(I)*TORAD-ACHD
      YPB    = ANGD(I+1)*TORAD-ACHD
      CURVB(I)=(4.*YPA+2.*YPB)/(CHD*(1.+1.5*YPA*YPA))
      CURV(I+1)=(-2.*YPA-4.*YPB)/(CHD*(1.+1.5*YPB*YPB))
      GO TO 165
  160 IF(I.EQ.1) GO TO 165
      IF(CURVB(I-1).EQ.BITS) CURVB(I-1)=CURVB(I)
  165 I      = I+1
      IF(I.LT.NZ) GO TO 155
      CURVB(I)=0.0
*REL013      RELOCATE FROM A ONE TO A THREE DIMENSIONED ARRAY *REL013*
C     SUBROUTINE REL013

C     INPUT-
C      Z,R    = BOUNDARY COORDINATES
C      ANGD   = ANGLE OF THE BOUNDARY (DEGREES)
C      NZ     = NUMBER OF BOUNDARY COORDINATE POINTS
C      FLIP   = SCALER ON R(I) BEFORE ROTATION OR TRANSLATION
C      ROTATE= ANGULAR ROTATION IN DEGREES
C      ZPIVOT,RPIVOT=PIVOT POINT FOR ROTATION BEFORE SCALING
C      SCALE = MULTIPLICATIVE CONSTANT ON INPUT COORDINATES
C      ZTRANS= Z-TRANSLATION AFTER SCALING
C      RTRANS= R-TRANSLATION AFTER SCALING
C      BDY    = BOUNDARY NAME
C      UPPER = T IF UPPER BOUNDARY, = F IF LOWER BOUNDARY
C      CHN    = CHANNEL NAME
C      LBDE   = NEXT AVAILABLE LOCATION IN THE BOUNDARY TABLE

C     OUTPUT-
C      BDT    = TABLE OF Z,R,ANG  IN 3-D ARRAY FORM
C      LBDE   = NEXT AVAILABLE LOCATION IN THE BOUNDARY TABLE

      IF(FLIP.NE.1. .OR. ROTATE.NE.0. .OR. SCALE.NE.1. .OR. ZTRANS.NE.0.
     1 .OR. RTRANS.NE.0.) WRITE (6,1151) FLIP,ROTATE,ZPIVOT,RPIVOT,
     2 SCALE,ZTRANS,RTRANS
      WRITE (6,1152)
      LB1    = LBDE
      LB2    = LB1+3*(NZ-1)
      LB     = LB1
      BDT(LB)=BDY
      CHNAME(LB)=CHN
      LBZ1(LB)=0
      UP(LB)= UPPER
      LEDEX(LB)=0
      I      = 1
      LBDEL = 3
      ADDPI = 0.
      IF(.NOT.UPPER) GO TO 240
      LB     = LB2
      LBDEL = -3
      ADDPI = PI
  240 ROTAT = ROTATE*TORAD
      SN     = SIN(ROTAT)
      CS     = COS(ROTAT)
  250 IF(ROTATE.NE.0.) GO TO 260
```

```
      ZBT(LB)=Z(I)*SCALE + ZTRANS
      RBT(LB)=R(I)*FLIP*SCALE + RTRANS
      GO TO 270
  260 RFLP   = R(I)*FLIP
      ZBT(LB)=(ZPIVOT+CS*(Z(I)-ZPIVOT)-SN*(RFLP-RPIVOT))*SCALE + ZTRANS
      RBT(LB)=(RPIVOT+CS*(RFLP-RPIVOT)+SN*(Z(I)-ZPIVOT))*SCALE + RTRANS
  270 ANGD(I)=ANGD(I)*FLIP + ROTATE
      ANGBT(LB)=ANGD(I)*TORAD + ADDPI
      WRITE (6,1280) I,ZBT(LB),RBT(LB),ANGD(I),CURV(I),CURVB(I)
      IF(I.GE.NZ) GO TO 300
      I      = I+1
      LB     = LB+LBDEL
      GO TO 250
  300 LBDE   = LB2+9
      LBNEXT(LB1)=LBDE-LB1
      BDT(LBDE)=BLANK
C     END SUBROUTINE REL013


C    SET UP BOUNDARY LAYER INPUT TABLE

      IBLB(LBLB)= IBDY
      IBLB(LBLB+1)= 0
      IF( BL) IBLB(LBLB+1)=1
      BLB(LBLB+2)= CAPX1
      LBLB   = LBLB+3
  900 RETURN

 1055 FORMAT(//1X48H**    NO COORDINATE INPUT WAS FOUND FOR BDY=A6,//)
 1090 FORMAT(///1X,45HB O U N D A R Y  C O O R D I N A T E S,  BDY=A6,
     * 5X4HCHN=A6,5X6HUPPER=
     *L2,6X,3HBL=L2,)
 1100 FORMAT(/6X46HDOUBLE POINTS WITH ANGLE DIFFERENCES LESS THANF6.3,1X
     *24HARE ELIMINATED  (DBLPTS=F5.3,2H),)
 1151 FORMAT(/6X5HFLIP=F7.3,3X7HROTATE=F8.3,3X7HZPIVOT=F10.5,3X7HRPIVOT=
     *F11.5,3X5HSCALEF7.3,3X7HZTRANS=F10.5,3X7HRTRANS=F10.5,)
 1152 FORMAT (/9X48HI    X,Z        Y,R        ANGD      CURV-      CURV+ )
 1280 FORMAT(I10,2F10.5,F10.3,2F10.4)
      END
```

```
*DECK CRBD
      BLOCK DATA RBDBLK
*CRBD--          BLOCK DATA FOR RBD ROUTINE                          @CRBD@
*SMOBLK          SMOOTH BLOCK COMMON                                 @SMOBLK@
      COMMON /CSMOOD/ SGAMMA,SZETA1,SZETAN
      DATA SGAMMA,SZETA1,SZETAN/  1.,1.E2,1,E2/
      END
```

```
*DECK RCD
      SUBROUTINE RCD
*RCD--*         READ IN CHANNEL DATA                                  *RCD*

C     INPUT-
C      CHDATA= CHANNEL INPUT DATA TABLE
C      LHE    = NEXT AVAILABL LOCATION IN CHANNEL INPUT DATA TABLE
C

C     OUTPUT-
C      LCHE   = NEXT AVAILABL LOCATION IN CHANNEL INPUT DATA TABLE
C      CHDATA= CHANNEL INPUT DATA TABLE INCLUDING NEW INPUT VALUES

C     CHANNEL INPUT DATA TABLE
C      INDEX- LH=LHO,LHE
      COMMON /CHDATA/ CHNAM(1),LHNEXT(1),WTFLOW(1),TTO(1),PTO(1),
     1                TSO(1),PSO(1),MACHO(1),AO(1),VARY(1),
     2                RG(1),GAM(1), NR(1),NC(1),TAB(6),
     4                BB(75)
       LOGICAL        VARY
       INTEGER CHNAM
       DIMENSION      VO(1)
       REAL           MACHO
       EQUIVALENCE    (VO,MACHO)
C
      COMMON          PROGM(8),PROGSV,FILIN,FILOT,REFS(5)
       LOGICAL                          FILIN,FILOT
      COMMON /CAO    / AOSV
      COMMON /CBITS  / BITS,BLANK
      COMMON /CNTRL  / K5,CHN(6),INSERT
       INTEGER CHN
       EQUIVALENCE    (ICHN,CHN)
      COMMON /CTABPR/ I1TAB
      COMMON /CTAPOS/ RESTRT,ENDBDT,ENDFIL,K6SV
       LOGICAL        RESTRT,ENDBDT,ENDFIL
      COMMON /SPACER/ MAXLH,MAXLT,MAXLF,MAXLW
      COMMON /TROUBL/ ERR,ERRMAJ,INERR,PRERR
       LOGICAL        ERR,ERRMAJ,INERR,PRERR
      COMMON /IXORIG/ LHO,LHE, LBDO,LBDE, LTO,LTE, LWO,LWE, LFO,LFE,
     *                LO,LESTA,  LDUM(8),
     *                MO,NM, NJ,NFCOLS, MAXNJ,MAXOL,MAXNM,MAXLE,
     *                LEO,LEE, LRO,LRE,LRD
       DIMENSION      LIMITS(24)
       EQUIVALENCE    (LIMITS,LHO)

      COMMON /ERASE / DUM(16),B(784)

      NAMELIST /A/ CHN,WTFLOW,TTO,TT,PTO,PT,
     1             TSO,PSO,MACHO,AO,VARY,
     2             GAM,RG,
     3             NR,NB,TAB,B

C     RESTART CASE WITH CHANNEL FLOW DATA REVISIONS
C      RELOCATE CHDATA FOR CHANNEL=CHN INTO FIRST POSITION
C      FIRST FIND INDEX  LH  FOR CHNAM=CHN
      LH     = LHO
   12 IF(LH.GE.LHE) GO TO 20
      IF(CHNAM(LH).EQ.CHN) GO TO 14
      LH     = LH+LHNEXT(LH)
      GO TO 12
   14 IF(LH.EQ.LHO) GO TO 16
      LNG    = LHNEXT(LH)
```

```
      LH1    = LHO+LNG
      LH2    = LH+LNG
      LH3    = LH2+LNG
      CALL MOVE(3, CHNAM(LHO),CHNAM(LH1),LHO-LHE-1,1,
     1             CHNAM(LH2),CHNAM(LHO),LNG,1,
     2             CHNAM(LH3),CHNAM(LH2),LHE+LNG-LH3+1,1)
   16 LHNXT = LHO+LHNEXT(LHO)
      GO TO 30

   20 CALL MOVE(1, CHNAM,CHNAM(21),LHO-LHE-1,1)
      LHNEXT= 20
      LHNXT = 21
      LHE    = LHE+20

C     INITIALIZE
      CALL SETM(1,BITS,WTFLOW,10)
      VARY   = .TRUE.

C     READ  CHN  INPUT CARDS
   30 CALL SETM(1,BITS, B,400)
      READ (5,A)
      AOSV   = AO(LH)
      IF(INERR) ERRMAJ=.TRUE.

C     RESET  CHNAM  IF CHANNEL NAME HAS BEEN REDEFINED
      CHNAM = CHN

C     COUNT THE LENGTH OF THE B-ARRAY
      NR     = 0
      NC1    = NC
      DO 40 I=1,400,NC1
      IF(B(I).EQ.BITS) GO TO 50
   40 NR     = NR+1
   50 NCR    = NC*NR

C     RELOCATE AND INSERT B-ARRAY INTO CHDATA-TABLE
      IF(NCR.EQ.0) GO TO 950
      LHNXTT= LHO+20+NCR
      NMOVE = LHE-LHNXT+1
      IF(LHNXTT.GT.LHNXT) NMOVE=-NMOVE
      CALL MOVE(2, CHNAM(LHNXT),CHNAM(LHNXTT),NMOVE,1, B,BB,NCR,1)
      LHE    = LHE+LHNXTT-LHNXT
      LHNEXT= 20+NCR

  950 IF(LHE.LT.LBDO) GO TO 980
      WRITE (6,1960) LHO,LHE,MAXLH,LBDO
      CALL ERROR1
  980 RETURN
 1960 FORMAT(/1X81H***  THE CHANNEL INPUT DATA TABLE HAS EXCEEDED ALLOTT
     *ED MEMORY.  INCREASE  MAXLH./6X4HLHO=I4,3X4HLHE=I4,3X6HMAXLH=I4,3X
     *5HLBDO=I4,)
      END
```

```
*DECK REDINP
      SUBROUTINE REDINP
*REDINP          STC READ INPUT                                    *REDINP*

      COMMON /BCOMMN/ PROGM(8),PROGSV,FILIN,FILOT
       LOGICAL                         FILIN,FILOT
      COMMON /ADAM01/ NAME(6),ADDRES(6),TITLE(6),IDENT(6)
      COMMON /ADAM02/ ENDJOB,NUMPLT,PLOTED,ENDCRD
       LOGICAL        ENDJOB,        PLOTED,ENDCRD
      COMMON /ALLCOM/ MACHA,PSA,TSA,PTA,TTA, AXIA,RGA,GAMA,
     &                MACHC,PSC,TSC,PTC,TTC, AXIC,RGC,GAMC,
     &                DAXIT,SCALEA,TTE,CHOTST
       LOGICAL        AXI,AXIA,AXIC,CHOTST
       REAL           MACHA(1),MACHC,MACHO(1)
       EQUIVALENCE    (MACHO,MACHC),(PSO,PSC),(TSO,TSC),(PTO,PTC),
     &                (TTO,TTC), (AXI,AXIC),(RG,RGC),(GAM,GAMC)
      COMMON /BENDIN/ NBCIN(2),ACF(2)
      COMMON /CBITS / BITS,BLANK
      COMMON /CCRX  / CRXSL,CRXOL,CRXSS,CRXE,CRXC,DCRX
       DIMENSION      CRX(6)
       EQUIVALENCE    (CRX,CRXSL)
      COMMON /CEND  / TBLEND(2)
      COMMON /CGRAV / CG
      COMMON /CIADIN/ RHOBAS,RHOAMP,IADM
      COMMON /CINNER/ INRCTR,RDUM,NINNER(16),CNVF(16)
      COMMON /CISBDT/ FARFLD(2),FREE(2),PRES(2),PSPISV,NZP,
     &                ZP(10),PSP(10),NZP1
       DIMENSION      PPS(10)
       EQUIVALENCE    (PPS,PSP)
       INTEGER        FARFLD,FREE,PRES,PSPISV
      COMMON /CIVP  / IVP,VPDUM,NRF(2),INR(2),XIVP(2)
      COMMON /CLWOSV/ LWOSV
      COMMON /CMAXIT/ MAXIT,MAJCTR,GREFIN,TL
       LOGICAL        GREFIN
       EQUIVALENCE    (MAXREF,MAXIT)
      COMMON /CNTRL / K5,STA(6),INSERT
      COMMON /CPLOT1/ PLOT,SAMEXY, XSCALE(4),YSCALE(4), XORG,YORG, SX,SY
       LOGICAL        PLOT,SAMEXY
       EQUIVALENCE    (IPLOT,PLOT)
      COMMON /CPRINT/ PDD(6),PDUM(20)
       EQUIVALENCE    (PRTES2,PDD)
      COMMON /CPRPRN/ PRPRN
       INTEGER        PRPRN
      COMMON /CPTMOV/ VELPOT,ICOB,NODENS,FBASTG
       LOGICAL        VELPOT
      COMMON /CREFIN/ DREFIN,SG21,VMG1,VMG2, NGR,NGZ,SGR(10),GR(10),
     &                SGZ(10),GZ(10)
      COMMON /CSS   / SSFML,SSEF,SSEANG,SSDF,SSFEND,SSFND1,
     &                DSS(2),RHOW,RHOWSS,TSIC,RHOC,RHOCSS
       INTEGER        SSFML
       LOGICAL             SSEF,          SSDF
      COMMON /CTAPOS/ RESTRT,STCFIL
       LOGICAL        RESTRT,STCFIL
      COMMON /CTE   / TOLWF, TOLWFU, TEXI2, TWF, TERWF, JRET
      COMMON /CTHICK/ NTHKX,NTHKY,THKX(25),THKY(25),THIK2D(250)
      COMMON /CTOLRL/ TOLRL,MAXSWP,CLEN,DTOLR1,TOLES2,NSWP,
     &                DS1DMP,DS1DP1,DTOLR2(4),SG1REF,TOLINR
      COMMON /FILES / ORGF,UPDF,NEWF,SCRF
       INTEGER        ORGF,UPDF,NEWF,SCRF
      COMMON /IXORIG/ LHO,LHE, LBDO,LBDE, LTO,LTE, LWO,LWE, LFO,LFE,
     &                 LO,LESTA, LSO,LSE, LDO,LDE, LDUM(4),
     &                MO,NM, NJ,NFCOLS, MAXNJ,MAXOL,MAXNM,MAXLE,
```

```
     &                  LEO,LEE, LRO,LRE,LRD
      DIMENSION         LIMITS(24)
      EQUIVALENCE       (LIMITS,LHO)
      COMMON /KEYS  /   KEYA(10),KEYB(10)
      COMMON /SLTAB /   W(128),X2(128),SLCHN(128)
      INTEGER                            SLCHN
      COMMON /SPACER/   MAXLH,MAXLT,MAXLF,MAXLW
      COMMON /TROUBL/   ERR,ERRMAJ,INERR,PRERR
      LOGICAL           ERR,ERRMAJ,INERR,PRERR

      COMMON /CHDATA/   TABLES(2046)
      COMMON /CB    /   B(768)
      COMMON /CM    /   JMS(768)
      COMMON /CR    /   RF(768)
      COMMON /CS1   /   S1(768)
      COMMON /CS2   /   S2(768)
      COMMON /CVM   /   VMF(768)
      COMMON /CZ    /   ZF(768)

      LOGICAL           FIRST

      DATA KA/1HA/, KBDY/3HBDY/, KCHN/3HCHN/, KSTA/3HSTA/
      DATA FIRST/T/
      COMMON /  CNORM / RHL,RM,AHL,AMM
      COMMON /TAPES / NTAPO,NTAPN

      COMMON /BLBDY / BLB(60)
      DIMENSION IBLB(60)
      EQUIVALENCE (IBLB,BLB)
      INTEGER BNAM
      COMMON /VISCOS/ TREF,MUREF,SCON
      REAL                 MUREF
      COMMON /REBL  / RESTBL
      LOGICAL         RESTBL
C     STCFIL= T IF A STC-SUBFILE EXISTS ON TAPE=ORGF.

      NAMELIST /A/ IDENT,
     & MACHO,PSO,TSO,PTO,TTO,AXI,RG,GAM,SCALE,TTE,CHOTST,
     & NBCIN,ACF,  CRXSL,CRXOL,CRXSS,CRXE,CRXC,CRX,
     & CG,  RHOBAS,RHOAMP,IADM,  INRCYR,NINNER,CNVF,
     & FARFLD,FREE,PRES,PSPISV,NZP,ZP,PSP,PPS,NZP1,
     & NRF,INR,XIVR,MXLRLX,
     & MAXREF,MAXIT,NREFIN,TL,  RN,  PLOT,IPLOT,SAMEXY,XSCALE,YSCALE,
     & PRTES2,PDD,RDUM,
     & PRPRN,  VELROT,ICOB,NODENS,FBASTG,
     & SG21,VMG1,VMG2,NGR,NGZ,SGR,GR,SGZ,GZ,
     & SSFML,SSEF,SSEANG,SSDF,SSFEND,SSFND1,
     & RHOW,RHOWSS,TSIC,RHOC,RHOCSS,
     & TOLWF,NTHKX,NTHKY,THKX,THKY,THK2D,
     & TOLRL,MAXSWP,TOLES2,DS1DMP,DS1DP1,SG1REF,TOLINR,
     & MAXLH,MAXLT,MAXLF,MAXLW,
     & LIMITS,TABLES, B,JMS,RF,S1,S2,VMF,ZF, W,X2,SLCHN
     &,TREF,MUREF,SCON,RHL,RM,INPBLR

C**   INITIALIZE AND READ OVERALL (A) INPUT DATA
      IF(.NOT.FIRST .AND. (K5.NE.KA .OR. ENDCRD)) GO TO 200
      IF(FIRST .AND. K5.EQ.KA) GO TO 100
      WRITE (6,1000)
      ERR    =  .TRUE.
      PROGSV= 0.
      GO TO 200
```

```
  100 PROGSV= 0.
      ENDBDT= .FALSE.
      INPBLR= 0
      FIRST = .FALSE.
      LINES = 64
      NREFIN= 0
      NTHKX = 0
      RESTRT= .TRUE.
      STCFIL= .FALSE.
      CALL SETM(1,BITS, MACHO,8)

C     DETERMINE FIELD ARRAY SIZE
      MAXLE = LOC2(TABLES,TBLEND)
      MAXNM = LOC2(RF,ZF)

C     READ INPUT FILE
  120 IF(.NOT.FILIN) GO TO 130
      REWIND NTAPO
      READ (NTAPO)  STCFIL,(LIMITS(I),I=1,24)
       LWOSV = LWO
      IF(STCFIL) GO TO 125
      ENDBDT= .TRUE.
      WRITE (6,1120)
      GO TO 130

  125 READ (NTAPO) ((IDENT(I),I=1,6),AXI,RG,GAM,MACHO,PSO,TSO,PTO,TTO,
     1  PRPRN,TTE,CHOTST,MAXIT,MAJCTR, (NINNER(I),I=1,16), VELPOT,ICOB,
     & NODENS,RN,NGR,NGZ,(SGR(I),I=1,40),VMG1,VMG2,INRCTR,DREFIN,SG21,
     3  NBCIN(1),NBCIN(2),ACF(1),ACF(2), SSFML,SSEF,SSEANG,SSDF,SSFEND,
     & SSFND1,(DSS(I),I=1,5),(FARFLD(I),I=1,8),
     * RHOC,RHOCSS,RHL,RM,
     *     TREF,MUREF,SCON,(BLB(I),I=1,60),
     5  (ZP(I),I=1,28), (TABLES(I),I=1,LESTA), (B(I),I=1,NM), (JMS(I),
     6  I=1,NM), (S1(I),I=1,NM), (S2(I),I=1,NM),(ZF(I),I=1,NM), (RF(I),
     7  I=1,NM), (VMF(I),I=1,NM), (W(I),I=1,NJ), (X2(I),I=1,NJ),
     & (SLCHN(I),I=1,NJ),TOLRL,MAXSQP,TOLES2,TOLINR,DS1DMP,DS1DP1,
     & (DTOLR2(I),I=1,4),SG1REF,
     & (CRX(I),I=1,6), RHOBAS,RHOAMP,IADM,NTHKX,NTHKY,
     &          (THKX(I),I=1,300),TOLWF)
C       CHECK TO SEE IF STC-A INPUT DATA EXCEEDED DIMENSIONS
       IF(NM.GT.LOC2(RF,ZF) .OR. LESTA.GT.LOC2(TABLES,TBLEND)) ERR=.TRUE.
       IF( LDE.NE.0 ) RESTBL=.TRUE.

C     READ CARD INPUT
  130 READ (5,A)
      DO 135 I=1,8
  135 IF(MACHO(I).NE.BITS) MACHA(I)=MACHO(I)

C     DEFINE THE CHARACTERISTIC LENGTH, CLEN
  142 CLEN  = SGR(1)
      IF(NGR.LE.1) GO TO 146
      DO 144 I=2,NGR
  144 CLEN  = CLEN+SGR(I)
  146 IF(NGZ.LE.0) GO TO 149
      DO 148 I=1,NGZ
  148 CLEN  = CLEN+SGZ(I)
  149 CLEN  = CLEN/FLOAT(NGR+NGZ)
      IF(SG1REF.EQ.0.) SG1REF=10.*CLEN

      IF(INPBLR.EQ.0) GO TO 155
```

```
C   READ BL INPUT CARDS(FIXED) FORMAT
      DO 155 I=1,INPBLR
      READ (5,156) BNAM,CAPX1
  156 FORMAT (1X,A10,F10,6)
C   SEARCH BL TABLE FOR ENTRY
      IBL    = -2
  157 IBL    = IBL+3
      IF(IBLB(IBL).EQ.BNAM) GO TO 158
      IF( IBLB(IBL).EQ.IBITS .OR. IBL.GE,58 ) GO TO 155
      GO TO 157
  158 IBLB(IBL+1) = 1
      BLB(IBL+2) = CAPX1
  155 CONTINUE

C     SET UP INDEX-ORIGIN TABLE IF THERE IS NO  STC-TAPE INPUT
C      ORDER OF TABLES IN BLOCK COMMON
C       LH     /CHDATA/
C       LB     /BDYTAB/
C       LT     /CONVTB/
C       LW     /WAKETB/
C       LF     /CADJWF/
C       L      /STATAB/
      IF(STCFIL) RETURN
      RESTRT= .FALSE.
      LBDO   = LHO+MAXLH
      LBDE   = LBDO
      RETURN
C     (OTHER INDEX LIMITS ARE SET IN SUBROUTINE BLDTBS)

C    READ BOUNDARY DATA
  200 CALL RBD
      IF(ENDCRD) GO TO 700
      IF(K5.EQ.KBDY) RETURN

C    READ CHANNEL DATA
  300 IF(K5.NE.KCHN) GO TO 400
C      IF RESTRT, UNPACK TABLES TO MAKE ROOM FOR NEW CHDATA AND CONVTB,
       IF(.NOT.RESTRT .OR. LBDO.GT.(LWE+1)) GO TO 350
       MOVE1 = LOC2(TABLES,S1)-LESTA
       MOVE2 = MOVE1/2
       LWTO  = LWO+MOVE1
       LBTO  = LBDO+MOVE2
       CALL MOVE(2, TABLES(LWO),TABLES(LWTO),LWO-LESTA-1,1,
     1              TABLES(LBDO),TABLES(LBTO),LBDO-LTE-1,1)
       LBDO  = LBDO+MOVE2
       LTE   = LTE+MOVE2
       LBDE  = LBDE+MOVE2
       LTO   = LTO+MOVE2
       LWO   = LWO+MOVE1
  350 CALL RCD
      RETURN

  400 WRITE(6,1000) K5
      ERRMAJ= .TRUE.
      RETURN

C    CONSTRUCT LETEPT, ORTCHN, CONVTB, SLTAB, STATAB AND THE FIELD TABLE
  700 IF(ERRMAJ .OR. LBDE.EQ.LBDO) ERR=.TRUE.
  900 RETURN
 1000 FORMAT(/1X73HERROR- THE K5=A INPUT DATA DOES NOT IMMEDIATELY FOLLO
     *W THE PROGM=STC CARD)
```

```
1120 FORMAT(//1X43H***  NO  STC  DATA FOUND ON THE INPUT TAPE.//)
1136 FORMAT(/29H ***  NZP EXCEEDS DIM OF (10))
1690 FORMAT(//1X44H**   PLEASE CHECK THE INPUT VALUE OF K5 (K5=A6,18H),
    *  IT MUST BE ONE/6X37HOF THE FOLLOWING=   A, BDY, CHN, STA,//)
     END
```

```
*DECK BUILDT
      OVERLAY(STC,1,2)
      PROGRAM BUILDT
      COMMON /CMAXIT/  MAXIT,MAJCTR,GREFIN,EDUM
      LOGICAL                 GREFIN
      COMMON /CPRINT/  PRTES2,PRTB,PRTA,PREFIN,PREFN2,SSONIC,PDUM(20)
      COMMON /TROUBL/ ERR,ERRMAJ,INERR,PRERR
       LOGICAL        ERR,ERRMAJ,INERR,PRERR
      COMMON /SELECT/ LENTRY

      GO TO (5,10,15) , LENTRY
    5 CALL BLDTAB
      GO TO 20
   10 CALL BPSORT
      MAJCTR= 0
C   INSERT SPECIAL BOUNDARY TYPES IN THE STATION TABLE
   15 CALL ISBOT
      IF(ERR) CALL ERROR1
      IF(PDUM(10).NE.0.) CALL EDUMP
   20 RETURN
      END
```

```
*DECK BLDTAB
      SUBROUTINE BLDTAB
*BLDTAB          COALLATE BDY-TABLE, BUILD LE-TE PT TABLE    *BLDTAB*

C     INPUT-
C      BOUNDARY TABLE, /BDYTAB/
C      CHANNEL INPUT DATE, /CHDATA/

C     OUTPUT-
C      CONDENSED BOUNDARY TABLE, /BDYTAB/
C      ORDERED EDGE POINTS, /LETEPT/

C     BOUNDARY TABLE
C      INDEX- LB=LBDO,LBDE
C      LBNEXT= INCREMENT TO NEXT BOUNDARY
C      LBZ1  = INCREMENT TO THE FIRST BOUNDARY POINT (=0 BEFORE COALLATIO
C      CHNAME= CHANNEL WITH WHICH THE BOUNDARY DATA IS ASSOCIATED
C      UP    = T OR F FOR UPPER OR LOWER BOUNDARY
C      LEDEX = RELATIVE INDEX OF L.E. POINT WHEN LOWER AND UPPER SURFACE
C               CONTOURS ARE CONNECTED
C      BDNAME,LBA,LBB=NAME AND INDEX LIMITS OF SPECIFIC BOUNDARY
C                     DATA WHEN BOUNDARIES ARE COALLATED
       COMMON /CHDATA/ BDT(1),LBNEXT(1),LBZ1(1),
     1                 CHNAME(1),UP(1),LEDEX(1),
     2                 ZBT(1),RBT(1),ANGBT(42)
        LOGICAL        UP
        INTEGER BDT,CHNAME,BDNAME
        DIMENSION      BDNAME(1),LBA(1),LBB(1)
        EQUIVALENCE    (BDNAME,ZBT), (LBA,RBT), (LBB,ANGBT)
C
       COMMON /ALLCOM/ MACHA,PSA,TSA,PTA,TTA, AXIA,RGA,GAMA,
     1                 MACHC,PSC,TSC,PTC,TTC, AXIC,RGC,GAMC,
     2                 DAXIT,SCALEA,YTE,CHOTST
        REAL           MACHA(1),MACHC
        LOGICAL        AXIA,AXIC,CHOTST
       COMMON /IXORIG/ LHO,LHE, LBDO,LBDE, LTO,LTE, LWO,LWE, LFO,LFE,
     *                 LO,LESTA,  LDUM(8),
     *                 MO,NM, NJ,NFCOLS, MAXNJ,MAXOL,MAXNM,MAXLE,
     *                 LEO,LEE, LRO,LRE,LRD
        DIMENSION      LIMITS(24)
        EQUIVALENCE    (LIMITS,LHO)
C     TABLE OF LEADING EDGE AND TRAILING EDGE POINTS
C      INDEX- LE=LEO,LEE,10
C      NLE,NTE=NO. OF L.E. AND T.E. COINCIDENT PTS. RESPECTIVELY
C      CHL,CHU=NAME OF CHANNEL ABOVE AND BELOW PT, RESPECTIVELY
C      BDL,BDU=BOUNDARY NAMES ASSOCIATED WITH THE POINTS
C      NUSED = COUNT OF TIMES THAT POINT USED IN CONSTRUCTION OF /ORTCHN/
       COMMON /LETEPT/ XE(1),YE(1),ANGE(1),NLE(1),NTE(1),
     1                 CHL(1),CHU(1),BDL(1),BDU(1),NUSED(491)
        INTEGER        CHL,CHU,BDL,BDU

       COMMON /CBITS / BITS,IBLANK
       COMMON /CPI   / PI,TWOPI,PIO2,PIO4,TODEG,TORAD
       COMMON /ERASE / XX(1),YY,ANGG,NL,NT,CNL,CNU,BNL,BNU,NZERO
        DIMENSION      IXX(10)
        EQUIVALENCE    (IXX,XX)
        INTEGER        CNL,CNU,BNL,BNU
       COMMON /TROUBL/ ERR,ERRMAJ,INERR,PRERR
        LOGICAL        ERR,ERRMAJ,INERR,PRERR

       INTEGER     BD1,BD2,BNAME2,CHN,HLOWER,HUPPER,UPPER
       LOGICAL     WALL
```

```
      DATA HLOWER,HUPPER/5HLOWER,5HUPPER/

C     RELOCATE BDY-TABLE DOWN AND ADJACENT TO CHDATA-TABLE
      NMOVE = LBDE-LBDO+1
      CALL MOVE(1, BDT(LBDO),BDT(LHE+1),NMOVE,1)
      LBDO  = LHE+1
      LBDE  = LHE+NMOVE

C     DEFINE DOUBLE POINT TOLERANCE, DPTOL
      DPTOL = 1.E-5

C**   BOUNDARY TABLE SORT
C     RELOCATE TOGETHER THE BOUNDARIES WHICH BELONG TO THE SAME WALL
      LB1    = LBDO
  305 LB2    = LB1+LBNEXT(LB1)
      IF (LB2.GE.LBDE) GO TO 350
C     COMPARE CHANNEL NAME AND UPPER(LOWER) WALL
  310 IF(CHNAME(LB2).NE.CHNAME(LB1) .OR. (UP(LB2).AND. .NOT.UP(LB1))
     * .OR. (UP(LB1).AND. .NOT.UP(LB2)) ) GO TO 340
C     DOES LB2 FOLLOW LB1, COMPARE THE Z,R VALUES OF THE END POINTS
      L1     = LB1+LBNEXT(LB1)-9
      IF(ABS(ZBT(LB2)-ZBT(L1)).LT.DPTOL .AND.
     1   ABS(RBT(LB2)-RBT(L1)).LT.DPTOL) GO TO 315
C     DOES LB2 PRECEED LB1
      L2     = LB2+LBNEXT(LB2)-9
      IF(ABS(ZBT(L2)-ZBT(LB1)).GE.DPTOL .OR.
     1   ABS(RBT(L2)-RBT(LB1)).GE.DPTOL) GO TO 340
      LI     = LB1
      GO TO 316
  315 LI     = LB1+LBNEXT(LB1)
  316 NB2    = LBNEXT(LB2)
      LT     = LI+NB2
      L2     = LB2+NB2
      L22    = L2+NB2
      IF(LB2.EQ.LI)GO TO 340
      CALL MOVE(3, BDT(LI),BDT(LT),LI-1-LBDE,1,
     1             BDT(L2),BDT(LI),NB2,1,
     2             BDT(L22),BDT(L2),LBDE-L2+1,1)
      IF(LI.EQ.LB1) GO TO 305
  340 LB2    = LB2+LBNEXT(LB2)
      IF(LB2.LT.LBDE) GO TO 310
      LB1    = LB1+LBNEXT(LB1)
      GO TO 305

C**   COALLATE THE BOUNDARIES ALONG ONE WALL INTO ONE CONTOUR
  350 LB1    = LBDO
  355 NCOAL  = 0
      CHN    = CHNAME(LB1)
      WALL   = UP(LB1)
  360 LB2    = LB1+LBNEXT(LB1)
      IF(LB2.GE.LBDE .OR. BDT(LB2).EQ.IBLANK) GO TO 400
C     IS THIS BOUNDARY CONTINUED
      IF(CHNAME(LB2).NE.CHN .OR. (UP(LB2).AND. .NOT.WALL) .OR.
     * (WALL .AND. .NOT.UP(LB2)) ) GO TO 380
      L1     = LB1+LBNEXT(LB1)-9
      L2     = LB2+LBZ1(LB2)
      IF(ABS(ZBT(L2)-ZBT(L1)).LT.DPTOL .AND.
     1   ABS(RBT(L2)-RBT(L1)).LT.DPTOL) GO TO 365
C      ERROR- BOUNDARY TABLE NOT CONTINUOUS
      IUP=HLOWER
```

```
      IF( UP(LB1) ) IUP=UPPER
      WRITE(6,1365) IUP,CHNAME(LB1),ZBT(L1),RBT(L1),ZBT(L2),
     1              RBT(L2)
      CALL ERROR1
C     MOVE THE LB1 Z,R,ANG-DATA UP 6 SPACES IF THERE EXISTS
C      AN ANGLE DISCONTINUITY, 9 SPACES IF THERE DOES NOT.
C      (6 SPACES IS NOW ALWAYS USED SO THAT A PRIMARY ORTHOGONAL WILL BE
C      GENERATED AT BOUNDARY JUNCTIONS. 4/71)
  365 LUP    = 6
C     IF(ANGBT(L2).EQ.ANGBT(L1)) LUP=9
      LF     = LB1+6+LBZ1(LB1)
      LT     = LF+LUP
      NMOVE  = -((LB1+LBNEXT(LB1)) - LF)
      BNAME2= BDT(LB2)
      LNEXT2= LBNEXT(LB2)
      LSTART= LBZ1(LB2)

      CALL MOVE(1, BDT(LF),BDT(LT),NMOVE,1)

      IF(NCOAL.NE.0) GO TO 370
      NCOAL = 1
      BDNAME(LB1)=BDT(LB1)
      LBA(LB1)=LBZ1(LB1)
      LBB(LB1)=LBA(LB1)-NMOVE-3

  370 L1     = LB1+3*NCOAL
      BDNAME(L1)=BNAME2
      LBA(L1)=LBNEXT(LB1)
      LBB(L1)=LBA(L1) + (LNEXT2-(6+LSTART)) - 3
      N      = NCOAL
      NCOAL = NCOAL+1

  375 IF(N.LE.0) GO TO 377
      L1     = LB1+3*(N-1)
      LBA(L1)=LBA(L1)+LUP
      LBB(L1)=LBB(L1)+LUP
      N      = N-1
      GO TO 375

  377 LBNEXT(LB1)=LBNEXT(LB1)+LNEXT2
      LBZ1(LB1)=LBZ1(LB1)+LUP
      GO TO 360

C     ELIMINATE GAPS
  380 IF(NCOAL.EQ.0) GO TO 390
      LDOWN = LBZ1(LB1) - 3*NCOAL
      IF(LDOWN.LE.0) GO TO 390
      LF     = LB1+6+LBZ1(LB1)
      LT     = LF-LDOWN
      NMOVE = LBDE-LF+1
      CALL MOVE(1, BDT(LF),BDT(LT),NMOVE,1)
      LBNEXT(LB1)=LBNEXT(LB1)-LDOWN
      LBZ1(LB1)=LBZ1(LB1)-LDOWN
      N      = 1
  385 L1     = LB1+3*(N-1)
      LBA(L1)=LBA(L1)-LDOWN
      LBB(L1)=LBB(L1)-LDOWN
      N      = N+1
      IF(N.LE.NCOAL) GO TO 385
      LBDE   = LBDE-LDOWN
```

```
C      INDEX TO THE NEXT LB1
  390 LB1    = LB1+LBNEXT(LB1)
      IF(LB1.LT.LBDE) GO TO 355

*      INITIALIZE FAR FIELD INTERFACE BOUNDARY DATA IF REQ*D
  400 CALL FFINIT

C**   BUILD LEADING EDGE/TRAILING EDGE POINT TABLE.   /LETEPT/
      LEE    = LEO-1
      LB     = LBDO
  405 L1     = LB+LBZ1(LB)
      LL     = L1
      L2     = LB+LBNEXT(LB)-9
      GO TO 410
C       SEARCH FOR SHARP CORNERS
  407 LL     = LL+3
      IF(ABS(ZBT(LL)-ZBT(LL-3)).LT.DPTOL .AND.
     1   ABS(RBT(LL)-RBT(LL-3)).LT.DPTOL) GO TO 408
      IF(LL.LT.L2) GO TO 407
      GO TO 410
C       SHARP CORNER
  408 ZBT(LL)=ZBT(LL-3)
      RBT(LL)=RBT(LL-3)
      NZERO = -1
      NL     = 0
      NT     = 0
      ANGG   = .5*(ANGBT(LL)+ANGBT(LL-3))
      GO TO 412
  410 NZERO = 0
      ANGG   = ANGBT(LL)
  412 CALL SETM(1,IBLANK, CNL,4)
      XX     = ZBT(LL)
      YY     = RBT(LL)
      IF(UP(LB)) GO TO 415
C       LOWER BOUNDARY
      CNL    = CHNAME(LB)
      BNL    = BDT(LB)
      IF(LL.EQ.L1) GO TO 420
      IF(LL.EQ.L2) GO TO 425
      GO TO 435
C       UPPER BOUNDARY
  415 CNU    = CHNAME(LB)
      BNU    = BDT(LB)
      ANGG   = ANGG-PI
      IF(LL.EQ.L1) GO TO 425
      IF(LL.EQ.L2) GO TO 420
      GO TO 435
C       LEADING EDGE
  420 NL     = 1
      NT     = 0
      GO TO 435
C       TRAILING EDGE
  425 NT     = 1
      NL     = 0

C 435 CALL ESORTP

*ESORTP           PRELIMINARY EDGE POINT SORT                   *ESORTP******
C      SUBROUTINE ESORT
```

```
C     INPUT-
C      XX(10)= DATA VECTOR TO BE INSERTED INTO ARRAY-XE
C      XE     = ARRAY OF VECTORS SORTED ACCORDING TO FIRST TWO ELEMENTS
C      LEO,LEE=INDEX LIMITS OF THE XE-ARRAY

C     OUTPUT-
C      XE     = REVISED ARRAY OF EDGE POINTS
C      LEE    = REVISED UPPER LIMIT OF XE-ARRAY

C     SEARCH FOR ORDERED POSITION - J
  435 CONTINUE
      J       = 0
   55 I       = 1
   60 LE      = 10*J + I-1 + LEO
      IF(LE.GE.LEE) GO TO 80
      XD      = XX(I)-XE(I,LE)
      IF(ABS(XD).LE.(1.1*TTE)) XD=0.
      IF(XD) 80,70,65
   65 J       = J+1
      GO TO 55
   70 I       = I+1
      IF(I.LE.2) GO TO 60

C     THE NEW POINT IS COINCIDENT WITH POINT-J
      LE      = 10*J + LEO
      ANGE(LE)=.5*(ANGE(LE)+ANGG)
      NLE(LE)=NLE(LE)+NL
      NTE(LE)=NTE(LE)+NT
      I       = 6
   72 LE      = 10*J + I-1 + LEO
      IF(IXX(I).NE.IBLANK) XE(LE)=XX(I)
      I       = I+1
      IF(I.LE.10) GO TO 72
C     RETURN
      GO TO 436

C     RELOCATE AND INSERT THE NEW LINE IN LINE-J
   80 LEF     = 10*J + LEO
      LET     = LEF+10
      CALL MOVE(2, XE(LEF),XE(LET),LEF-LEE-1,1,
     1            XX,XE(LEF),10,1)
      LEE     = LEE+10
C     RETURN
C     END                                                    *************

  436 IF(LL-L2) 407,440,407

C     INCREMENT BOUNDARY TABLE INDEX
  440 LB      = LB+LBNEXT(LB)
      IF(LB.LT.LBDE) GO TO 405

C     CHECK FOR A MINIMUM OF  4  POINTS IN THE LETEPT-TABLE
      IF((LEE-LEO+1).LT.40) CALL ERROR1

C*    FINAL SORT OF /LETEPT/ BY AVERAGE FLOW ANGLE
      TANG    = 92./90.*PIQ2
      LE1     = LEO
  454 NCOUNT= (LEE+1-LE1)/10
  455 LE2     = LE1
  460 LE2     = LE2+10
      IF(LE2.GE.LEE) GO TO 470
```

```
C     IS PT2 IN FRONT OF PT1 (VECTOR PT1 TO PT2 GT 90 DEG FROM SL)
      ANGSL  = .5*(ANGE(LE1)+ANGE(LE2))
      ANG12  = ATAN8(YE(LE2)-YE(LE1),XE(LE2)-XE(LE1),ANGSL)
      IF(ABS(ANG12-ANGSL).LE.TANG) GO TO 460

C     MOVE PT LE2 IN FRONT OF LE1
      LI     = LE1
      LT     = LI+10
      L2     = LE2+10
      L22    = L2+10
      CALL MOVE(3, XE(LI),XE(LT),LI-1-LEE,1,
     1             XE(L2),XE(LI),10,1,
     2             XE(L22),XE(L2),LEE-L2+1,1)
      NCOUNT= NCOUNT-1
      IF(NCOUNT.GE.0) GO TO 455
       WRITE (6,1468)
       CALL ERROR1

C    INDEX LE1
 470  LE1    = LE1+10
      IF(LE1.LT.LEE) GO TO 454

C*   COMBINE UPPER AND LOWER CONTOURS CONNECTED BY L.E. IN THE BDY-TABLE
C     LB1 AND LB2 ARE INDICIES OF THE TWO CONTOURS
C                   (LOWER AND UPPER SURFACE)
C     LUP    = ADDITIONAL SPACE REQD FOR SUBTABLE OF INCLUDED BOUNDARIES
      LE     = LEO
 472  IF(NLE(LE).NE.2) GO TO 496
      BD1    = BDU(LE)
      BD2    = BDL(LE)
      LB1    = LBF(BD1)
      LB2    = LBF(BD2)

C    CHECK L.E. ANGLE DISCREPANCY
      LB     = LB2+LBZ1(LB2)
      ANGD2  = ANGBT(LB)*TODEG
      NBD2   = BDT(LB2)
      LB     = LB1+LBNEXT(LB1)-9
      ANGD1  = ANGBT(LB)*TODEG
      NBD1   = BDT(LB1)
      IF(ABS(ANGD2-ANGD1).LT..1) GO TO 474
      ANGDAV= .5*(ANGD1+ANGD2)
      WRITE (6,1473) ZBT(LB ),RBT(LB ),NBD1,NBD2,ANGD1,ANGD2,ANGDAV
 1473 FORMAT (//52H ***  ERROR - THE BOUNDARY ANGLES AT L.E. POINT  Z =,
     1           F10.5,4H R =,F10.5//14X,17HARE NOT THE SAME,
     2           33H  THE AVERAGE VALUE WILL BE USED.//21X,7HBDY =  ,A6,6X,
     3           7HBDY =  ,A6/21X,5HANGD=,F8.3,6X,5HANGD=,F8.3//29X,
     4           8HAVG-ANG=,F8.3)
      ANGBT(LB)=ANGDAV*TORAD

C     MAKE ROOM FOR SUBTABLE OF INCLUDED BOUNDARIES
 474  LUP    = MAX0(3,LBZ1(LB1)) + MAX0(3,LBZ1(LB2)) - LBZ1(LB1)
      LB     = LB1+LBZ1(LB1)
      LT     = LB+LUP
      CALL MOVE(1, ZBT(LB),ZBT(LT),LB+5-LBDE,1)
      LBDE   = LBDE+LUP
      IF(LB2.GE.LB1) LB2=LB2+LUP

C     INCLUDED BOUNDARIES IN COUNTOUR LB1
      IF(LBZ1(LB1).NE.0) GO TO 475
```

```
      BDNAME(LB)=BDT(LB)
      LBA(LB)= LUP
      LBB(LB)= LBA(LB)+LBNEXT(LB)-9
      LB     = LB+3
      GO TO 480
  475 LBN1   = LB1
  476 LBA(LBN1)=LBA(LBN1)+LUP
      LBB(LBN1)=LBB(LBN1)+LUP
      LBN1   = LBN1+3
      IF(LBN1.LT.LB) GO TO 476

C     UPPER SURFACE CHANNEL NAME IS STORED ON TOP OF *UP*
C     LEDEX = INDEX OF LEADING EDGE PT ON THE CONTOUR
  480 CHNAME(LB1+1)=CHNAME(LB2)
      LEDEX(LB1)=LBB(LB-3)

C     INCLUDED BOUNDARIES IN CONTOUR LB2
      IF(LBZ1(LB2).NE.0) GO TO 485
      BDNAME(LB)=BBT(LB2)
      LBA(LB)=LBB(LB-3)
      LBB(LB)=LBA(LB)+LBNEXT(LB2)-9
      GO TO 490
C      RELOCATE INDEX LIMITS OF UPPER BOUNDARIES
  485 LBN2   = LB2
      LBDIF  = LBB(LB-3)-LBA(LB2)
  486 BDNAME(LB)=BDNAME(LBN2)
      LBA(LB)=LBA(LBN2)+LBDIF
      LBB(LB)=LBB(LBN2)+LBDIF
      LB     = LB+3
      LBN2   = LBN2+3
      IF(LBN2.LT.(LB2+LBZ1(LB2))) GO TO 486

C     RELOCATE LB2-COORDINATES INTO LB1-COUNTOUR,  NB2=NUMBER OF DATA
C     POINTS TO BE MOVED.
  490 NB2    = LBNEXT(LB2)-LBZ1(LB2)-9
      LI     = LB1+LBNEXT(LB1)+LUP
      LT     = LI+NB2
      L2     = LB2+LBZ1(LB2)+9
      L22    = LB2+LBNEXT(LB2)
      IF(LB2.LT.LB1) GO TO 494
      LB2    = LB2+NB2
      L2     = L2+NB2
      L22    = L22+NB2
  494 LBZ1(LB1)=LBZ1(LB1)+LUP
      LBNEXT(LB1)=LBNEXT(LB1)+LUP+NB2
      CALL MOVE(3, BDT(LI),BDT(LT),LI-1-LBDE,1,
     1              BDT(L2),BDT(LI),NB2,1,
     2              BDT(L22),BDT(LB2),LBDE+NB2+1-L22,1)
      LBDE   = LBDE+NB2-(L22-LB2)

      DO 495 LEX=LE0,LEE,10
  495 IF(BDL(LEX).EQ.BD2) BDL(LEX)=BD1
  496 LE     = LE+10
      IF(LE.LT.LEE) GO TO 472

      RETURN

 1468 FORMAT(/1X70HERROR- THE L.E., T.E. AND BOUNDARY POINTS CAN NOT BE
     *ORDERED ACCORDING/8X64HTO ORTHOGONAL NUMBER.  PLEASE CHECK S.L. AN
     *GLES IN TABLE-LETEPT.)
 1365 FORMAT(///1X8H**    THE3X,A6,1X25HBOUNDARY CONTOUR FOR CHN=A6,1X17H
```

```
*IS NOT CONTINUOUS/6X9HAT POINTSF11,5,1H,F10.5,1X3HANDF11,5,1H,F10.
*5,1H,/6X59HTHE FOLLOWING TABLE CONTAINS THE BOUNDARY COORDINATE IN
*PUT,)
 END
```

```
*DECK BPSORT
      SUBROUTINE BPSORT
*BPSORT           BOUNDARY POINT SORT                             *BPSORT*

C     STATION TABLE
C      INDEX- L=LO,LESTA
C      SCHOKE= STATION CHOKE INDICATOR (ADJWF,BRHS,WRIOUT)
C      MCL    = SHARP CORNER INDICATOR (BLDTBS)
C      MCL    = FIELD INDEX OF CONTROL STREAMLINE (PTMOVE,FLOBAL)
      COMMON /CHDATA/ X1(1),LNEXT(1),MLB(1),MUB(1),PRIM(1),
     1                TYPELB(1),NAMELB(1),ILB(1),FLB(1),S1LB(1),
     1                TYPEUB(1),NAMEUB(1),IUB(1),FUB(1),S1UB(1),
     &                VMB(1),DWDV(1),X2CL(1),SLSWI(1),MCL(1),
     &                ANGTE(1),PTTE(1),PSTE(1),FGRTE(1),RGTE(1),
     &                ANGEXP(1),BSQEXP(475)
        DIMENSION     CRVLE(1),ANGLE(1)
        EQUIVALENCE   (SCHOKE,DWDV),(CRVLE,ANGTE),(ANGLE,PTTE)
        INTEGER       PRIM,TYPELB,TYPEUB,SCHOKE(1)
C
C     FIELD TABLES
C      INDEX- M=MO,NM
      COMMON /CZ    / Z(300)
      COMMON /CR    / R(300)
      COMMON /CS2   / S2(300)
      COMMON /CS1   / S1(300)
      COMMON /CPHI1 / PHI1(300)
      COMMON /CM    / JMS(300)
      COMMON /CCURV / CURV(300)

      COMMON /CB    / B(300)
      COMMON /CIDEX / M,J,MU,MD,ISTAG
      COMMON /IXORIG/ LHO,LHE, LBDO,LBDE, LTO,LTE, LWO,LWE, LFO,LFE,
     *                LO,LESTA,  LDUM(8),
     *                MO,NM, NJ,NFCOLS, MAXNJ,MAXOL,MAXNM,MAXLE,
     *                LEO,LEE, LRO,LRE,LRD
       DIMENSION      LIMITS(24)
       EQUIVALENCE    (LIMITS,LHO)
      COMMON /SLTAB / W(128),X2(128),SLCHN(128)
       INTEGER SLCHN
      COMMON /TROUBL/ ERR,ERRMAJ,INERR,PRERR
       LOGICAL        ERR,ERRMAJ,INERR,PRERR

C     BEGIN LOOP THROUGH STATION TABLE
      L1      = LO

C      LOWER BOUNDARY
   60 L2      = L1+LNEXT(L1)
   65 IF(L2.GE.LESTA) GO TO 100
      IF(NAMELB(L1).EQ.NAMELB(L2)) GO TO 70
      L2      = L2+LNEXT(L2)
      GO TO 65
C      NAME AGREEMENT
   70 IF(FLOAT(ILB(L2))+FLB(L2) - FLOAT(ILB(L1))-FLB(L1)) 80,85,100
C      SWITCH POINTS
   80 M1      = MLB(L1)
      M2      = MLB(L2)
      ISV     = ILB(L1)
      FSV     = FLB(L1)
      SSV     = S1LB(L1)
      RSV     = R(M1)
      ZSV     = Z(M1)
      ILB(L1)=ILB(L2)
```

```
      FLB(L1)=FLB(L2)
      S1LB(L1)=S1LB(L2)
      R(M1) = R(M2)
      Z(M1) = Z(M2)
      ILB(L2)=ISV
      FLB(L2)=FSV
      S1LB(L2)=SSV
      R(M2) = RSV
      Z(M2) = ZSV
      GO TO 100

C     COINCIDENT ORTHOGONALS
   85 M1     = MLB(L1)
      NAMBDY= NAMELB(L1)
      GO TO 187

C      UPPER BOUNDARY
  100 L2     = L1+LNEXT(L1)
  165 IF(L2.GE.LESTA) GO TO 190
      IF(NAMEUB(L2).EQ.NAMEUB(L1)) GO TO 170
      L2     = L2+LNEXT(L2)
      GO TO 165
C      NAME AGREEMENT
  170 IF(FLOAT(IUB(L1))+FUB(L1) - FLOAT(IUB(L2))-FUB(L2)) 180,185,190
C      SWITCH POINTS
  180 M1     = MUB(L1)
      M2     = MUB(L2)
      ISV    = IUB(L1)
      FSV    = FUB(L1)
      SSV    = S1UB(L1)
      RSV    = R(M1)
      ZSV    = Z(M1)
      IUB(L1)=IUB(L2)
      FUB(L1)=FUB(L2)
      S1UB(L1)=S1UB(L2)
      R(M1) = R(M2)
      Z(M1) = Z(M2)
      IUB(L2)=ISV
      FUB(L2)=FSV
      S1UB(L2)=SSV
      R(M2) = RSV
      Z(M2) = ZSV
      GO TO 190

C     COINCIDENT ORTHOGONALS
  185 M1     = MUB(L1)
      NAMBDY= NAMEUB(L1)
  187 ERR    = .TRUE.
      WRITE (6,1187) Z(M1),R(M1),NAMBDY

C     INDEX L1
  190 L1     = L1+LNEXT(L1)
      IF(L1.LT.LESTA) GO TO 60
      RETURN

 1187 FORMAT(45H ***  ERROR - COINCIDENT ORTHOGONALS AT POINT,2F10.5,11H
     * ALONG BDY=,A6)
      END
```

```
*DECK FFINIT
      SUBROUTINE FFINIT
*FFINIT          INITIALIZATION OF FAR FIELD CALC                   *FFINIT*

      COMMON /CISBOT/ FARFLD(2),FREE(2),PRES(2),RFF,NZP,
     1                ZP(10),PPS(10), A1,A2,ADUM(6)
       INTEGER        FARFLD,FREE,PRES

      RETURN
      END
```

```
*DECK FRFDNZ
      SUBROUTINE FRFDNZ
CFRFDNZ          GENERATE ZDN, ZIJ MATRIX FOR FAR-FIELD BC.          =FRFDNZ-
C
C     STATION TABLE
C      INDEX- L=LO,LESTA
C      SCHOKE= STATION CHOKE INDICATOR (ADJWF,BRHS,WRIOUT)
C      MCL   = SHARP CORNER INDICATOR (BLDTBS)
C.     MCL   = FIELD INDEX OF CONTROL STREAMLINE (PTMOVE,FLOBAL)
       COMMON /CHDATA/ X1(1),LNEXT(1),MLB(1),MUB(1),PRIM(1),
     1                 TYPELB(1),NAMELB(1),ILB(1),FLB(1),S1LB(1),
     1                 TYPEUB(1),NAMEUB(1),IUB(1),FUB(1),S1UB(1),
     &                 VMB(1),DWDV(1),X2CL(1),SLSWI(1),MCL(1),
     &                 ANGTE(1),PTTE(1),PSTE(1),FGRTE(1),RGTE(1),
     &                 ANGEXP(1),BSQEXP(475)
         DIMENSION     CRVLE(1),ANGLE(1)
         EQUIVALENCE   (SCHOKE,DWDV),(CRVLE,ANGTE),(ANGLE,PTTE)
         INTEGER       PRIM,TYPELB,TYPEUB,SCHOKE(1)
C
       COMMON /ALLCOM/ MACHA,PSA,TSA,PTA,TTA, AXIA,RGA,GAMA,
     1                 MACHC,PSC,TSC,PTC,TTC, AXIC,RGC,GAMC,
     2                 DAXIT,SCALEA,YTE,CHOTST
        REAL           MACHA(1),MACHC
        LOGICAL        AXIA,AXIC
        LOGICAL        CHOTST
       COMMON /IXORIG/ LHO,LHE, LBDO,LBDE, LTO,LTE, LWO,LWE, LFO,LFE,
     *                 LO,LESTA,  LDUM(8),
     *                 MO,NM, NJ,NFCOLS, MAXNJ,MAXOL,MAXNM,MAXLE,
     *                 LEO,LEE, LRO,LRE,LRD
        DIMENSION      LIMITS(24)
        EQUIVALENCE    (LIMITS,LHO)
       COMMON /ERASE2/ WSTA(100),DISP(100),WAKE(100),TT(100),PT(100),
     *                 LAM(100),RGX(100),C2CPX(100),DUM(534),
     *                 IN1(25),IN2(25,2),
     *                 NINT,M(21),EE(21),KK(21),XINT(21),
     *                 YINT(21),ZZ(21)
       REAL        M   ,   KK
       DIMENSION   XIJ(25,25),YIJ(25,25)
       EQUIVALENCE (WSTA,XIJ),(C2CPX,YIJ)
       COMMON /ERASE/ UNIT(25,25)
       COMMON  /CPI   / PI,DUMPI(5)
       COMMON  /CBITS /  BITS,BLANK
       COMMON /CFRFLD/ NFF,MAXFF,ZFF(64),RFF(64),
     *                           ZDN(25),DRDN(25),UDN(25),ZIJ(25,25)
       DIMENSION       FGRX(100)
       EQUIVALENCE     (FGRX,ZIJ)
       COMMON /CFRFIN/ ATINF,MINF,RFFREF,UINF,ZDN1,ZDN25
       REAL                 MINF
       COMMON /CPRINT/ PDUM(26)
       COMMON /CISBOT/ DUMIS(30),ADUM(6)
       COMMON /CPTMOV/ VELPOT,ICOB,NODENS,CPTDUM
       COMMON /CR    / R(300)
       EQUIVALENCE (R1,RFFREF),(R25,ADUM(2))
       LOGICAL   DSIZE
       REAL  M1,M2,M3,M4
       DATA AK1,AK2,AK3,AK4,AK5/
     * 1.3862944,.096663443,.035900924,.037425637,.0145119621/
       DATA BK1,BK2,BK3,BK4,BK5/
     * .5,.12498594,.06880249,.03328355,.00441787/
       DATA AE1,AE2,AE3,AE4/
     * .44325141,.06260601,.04757384,.01736506/
       DATA BE1,BE2,BE3,BE4/
```

```
     * .24998368,.8920018,.04069698,.005264496/
C*
C
C     INPUT***
C      MINF         = FREE STREAM MACH NUMBER ,
C      ZDN1,ZDN25= STREAMWISE LIMITS OF FAR FIELD :
C      RFFREF       = NOMINAL RADIUS OF FAR FIELD :
C     OUTPUT***
C      ZDN(1-25)  = STREAMWISE CO-ORDINATES FOR DN- FAR FIELD SOLUTION
C      ZIJ(25,25)= Z MATRIX = (INVERSE OF YIJ)*XIJ-
C     EXTENSION FRACTION TO FF= ADUM(1)

      BETA   = SQRT(1.-MINF**2)
      OBETA  = 1./BETA
C     INITIALIZE DZ, ZDN TABLE
C     TRANSFORM TO INCOMPRESSIBLE PLANE
      NDENSV= NODENS
      NODENS= -1
    1 DZFF   = ZDN25-ZDN1
      ZDN1   = ZDN1-ADUM(1)*DZFF
      ZDN25  = ZDN25+ADUM(1)*DZFF
      ZDN(1)= ZDN1*OBETA
      ZDN(25)= ZDN25*OBETA
      DZ     = (ZDN(25)-ZDN(1))/24.
      DO 2 K=2,24
    2 ZDN(K)= ZDN(K-1)+DZ
C     DETERMINE FF CROSS STREAM COORDINATE AT ZDN(25)
      L      = LESTA-19
      IF( LNEXT(L).NE.20 ) CALL ERROR1
      MA     = MLB(L)
      MB     = MUB(L)
      CALL TTPT(MA,MB,WSTA,DISP,WAKE,TT,PT,LAM,RGX,C2CPX,FGRX)
      NK     = MB-MA+1
C     ASSUME ISENTROPIC PROCESS TO UNDISTURBED CONDITIONS AT ZDN(25)
      GM2    = .5*(GAMA-1.)
      GM1    = (GAMA-1.)/GAMA
      PSINF  = PT(NK)/(1.+GM2*MINF**2)**(1./GM1)
      AREA   = 0.
      K      = 0
 1111 K      = K+1
      GMA    = (1.+FGRX(K))/FGRX(K)
      GM1    = 1./(GMA*FGRX(K))
      TSQTT  = (PSINF/PT(K))**GM1
      V2     = SQRT(C2CPX(K)*TT(K)*(1.-TSQTT))
      RHO2   = PT(K)/(RGX(K)*TT(K))*TSQTT**FGRX(K)
      IF( K.GT.1 ) GO TO 1112
      WQAKM1= RHO2*V2
      GO TO 1111
 1112 WQA    = RHO2*V2
      AREA   = AREA+2.*(WSTA(K)-WSTA(K-1))/(WQAKM1+WQA)
      WQAKM1= WQA
      IF( K.LT.NK ) GO TO 1111
      R25    = AREA+R(MA)
      IF( AXIA ) R25=SQRT(R(MA)**2+AREA/PI)
      IF( .NOT.AXIA ) GO TO 94
      NINT   = 11

C     INITIALIZE PARAMETERS FOR INTEGRATION

    3 DZZ    = DZ/FLOAT(NINT-1)
C     NOTE**** RADIAL CO-ORDINATE SCALED******
```

```
      DSING = 0.1*REFREF
      DSIZE =.TRUE.
      IF( DZZ.LE.DSING ) DSIZE=.FALSE.
      FA    = 4.*REFREF**2
      IF( DSIZE ) DELZD=DZZ-DSING
      DD    = AMIN1( DZZ,DSING )
      AL    = ALOG( .125*DD )
      SINGV = 2.*(-PI*DD*AL)-.125*DD**3*(1.+AL)
C     OUTER LOOP FOR CALC, OF XIJ,YIJ TABLES
      DO 90 I=1,25
C     INNER LOOP FOR CALC, OF XIJ,YIJ TABLES
      DO 89 J=1,25
C     SECTION TO BUILD TABLES FOR INTEGRATION
C     TABLES ARE BUILT IN 2 PASSES
      KGO   = 1
      IF( I.EQ.J ) GO TO 10
      IF( J.EQ.1 ) KGO=2
      IF( J.EQ.25) KGO=3
      GO TO 12
   10 KGO   = 4
      IF( J.EQ.1 ) KGO=5
      IF( J.EQ.25) KGO=6
   12 NIN   = NINT
      IF( KGO.NE.1 .AND. KGO.NE.4 ) NIN=(NINT-1)/2+1
      NMID=0
      IF( KGO.EQ.4 ) NMID=(NINT-1)/2+1
C     INITIAL PASS TO BUILD TABLES

      K     = 0
   15 K     = K+1
      K1    = K-1
      C     = 1.
      GO TO (20,25,20,30,35,40) , KGO
C     NORMAL BRANCH--OR  (J=25, I.NE.J )
   20 IF( K.GT.1 ) GO TO 22
   21 ZZ(K) = ZDN(J)-.5*DZ
      GO TO 23
   22 ZZ(K) = ZZ(K1)+C*DZZ
   23 M(K)  = FA/(FA+(ZDN(I)-ZZ(K))**2)
      GO TO 50
C     **(J=1,I.NEJ)
   25 IF( K.GT.1 ) GO TO 22
      ZZ(K) = ZDN(1)
      GO TO 23
C     NORMAL SINGULARITY BRANCH
   30 IF( K.EQ.1 ) GO TO 21
      IF( ZZ(K-1).NE.BITS ) GO TO 31
      K1    = K-2
      C     = 2.
   31 IF( K.NE.NMID ) GO TO 22
   32 ZZ(K) = BITS
      M(K)  = BITS
      GO TO 50
C     **(I=J,J=1)
   35 IF( K.GT.2 ) GO TO 22
      GO TO (32,36) , K
   36 ZZ(K) = ZDN(J)+DZZ
      GO TO 23
```

```
C     **(I=J,J=25)
   40 IF( K.EQ.1 ) GO TO 21
      IF( K.EQ.NIN ) GO TO 32
      GO TO 22
   50 IF( K.LT.NIN ) GO TO 15

C     FINAL PASS TO BUILD TABLES-- ADJUST FOR  SINGULARITIES CLOSER
C     THAN  DZZ

      IF( .NOT. DSIZE ) GO TO 70
      K       = 0
   55 K       = K+1
      IF( ZZ(K).NE.BITS ) GO TO 60
      GO TO (60,60,60,56,57,56) , KGO
   56 ZZ(K-1)= ZZ(K-1)+DELZD
      M(K-1)= FA/(FA+(ZDN(I)-ZZ(K-1))**2)
      IF( KGO.EQ.6 ) GO TO 60
   57 ZZ(K+1)= ZZ(K+1)-DELZD
      M(K+1)= FA/(FA+(ZDN(I)-ZZ(K+1))**2)
   60 IF( K.LT.NIN ) GO TO 55

C     EVALUATE ELLIPTIC INTEGRALS  (K(M),E(M))

   70 DO 71 L=1,NIN
      IF( M(L).EQ.BITS ) GO TO 71
      M1      = 1.-M(L)
      IF( M1.EQ.1. .OR. M1.EQ.0. ) CALL ERROR1
      M2      = M1*M1
      M3      = M2*M1
      M4      = M2*M2
      TLOG    = ALOG(1./M1)
C
C     EVALUATE KK
C
      KK(L) = AK1+AK2*M1+AK3*M2+AK4*M3+AK5*M4
     *        +(BK1+BK2*M1+BK3*M2+BK4*M3+BK5*M4) *TLOG
C
C     EVALUATE EE
C
      EE(L) = 1.+AE1*M1+AE2*M2+AE3*M3+AE4*M4
     *        +(BE1*M1+BE2*M2+BE3*M3+BE4*M4) *TLOG
C
   71 CONTINUE

C     CALCULATE INTEGRANDS  XINT,YINT

      DO 73 K=1,NIN
      IF( ZZ(K).EQ.BITS ) GO TO 73
      DEN    = SQRT(FA+(ZDN(I)-ZZ(K))**2)
      XINT(K)= -4.*RFFREF*EE(K)/(DEN*(ZDN(I)-ZZ(K)))
      YINT(K)= -2.*(KK(K)-EE(K))/DEN
   73 CONTINUE

C     INTEGRATE

   75 XIJI    = 0.
      YIJI    = 0.
      K       = 1
   76 K       = K+1
      GO TO (77,77,77,78,78,78) , KGO
   77 DZK     = ZZ(K)-ZZ(K-1)
```

```
      TERMX  = 0.5*(XINT(K)+XINT(K-1))
      TERMY  = 0.5*(YINT(K)+YINT(K-1))
      XIJI   = XIJI+TERMX*DZK
      YIJI   = YIJI+TERMY*DZK
      GO TO 80
C
   78 IF( (ZZ(K).NE.BITS) .AND. (ZZ(K-1).NE.BITS) ) GO TO 77
      IF( KGO.EQ.6 ) GO TO 80
      IF( KGO.EQ.4 ) K=K+2
      IF( KGO.EQ.5 ) K=K+1
      GO TO 77
C
   80 IF( K.LT.NIN ) GO TO 76
      XIJ(I,J)= XIJI
      IF( KGO.GT.3 ) YIJI=YIJI+SINGV
      YIJ(I,J)= YIJI
   89 CONTINUE
   90 CONTINUE
      IF( PDUM(26).EQ.0. ) GO TO 91
      CALL TABPRT(3HXIJ,XIJ,625,10)
      CALL TABPRT(3HYIJ,YIJ,625,10)
   91 CONTINUE

C     DETERMINE INVERSE OF YIJ

      CALL MATINV(YIJ,25,UNIT,0,DET,IN1,IN2,25,ISCALE)

      DO 93 I=1,25
      DO 93 J=1,25
      ZIJ(I,J)= 0.
      DO 92 K=1,25
   92 ZIJ(I,J)= ZIJ(I,J)+XIJ(I,K)*UNIT(K,J)
   93 CONTINUE
C     TRANSFORM BACK TO COMPRESSIBLE PLANE
      GO TO 97
   94 CALL SETM(1,0.,ZIJ,625)
      DO 96 I=1,25
      DO 95 J=1,25
      IF(I.EQ.J) GO TO 95
      DXIJP = ZDN(I)-(ZDN(J)+.5*DZ)
      DXIJM = ZDN(I)-(ZDN(J)-.5*DZ)
      ZIJ(I,J)= -1./PI*ALOG(DXIJP/DXIJM)
   95 CONTINUE
   96 CONTINUE
   97 CALL FMPYC(1, BETA,ZDN,ZDN,25)
      CALL FMPYC(1,0BETA,ZIJ,ZIJ,625)
      IF( PDUM(26).EQ.0. ) GO TO 200
      CALL TABPRT(5HYIJ-1,UNIT,625,10)
      CALL TABPRT(3HZIJ,ZIJ,625,10)
  200 NODENS= NDENSV
      WRITE (6,211) ZDN1,R1,ZDN25,R25
  211 FORMAT(//6X,29H*EXTENDED FAR FIELD BOUNDARY*/7X,2HZ=,F10.3,3X,
     * 2HR=,F10.3/7X,2HZ=,F10.3,3X,2HR=,F10.3/)
      RETURN
      END
```

```
*DECK ISBOT
      SUBROUTINE ISBOT
*ISBOT*         INSERT SPECIAL BOUNDARY TYPES                        *ISBOT*

C  COMB1
C   STATAB, CHDATA, BDYTAB
C    STATION TABLE
C     INDEX- L=LO,LESTA
C     SCHOKE= STATION CHOKE INDICATOR (ADJWF,BRHS,WRIOUT)
C     MCL   = SHARR CORNER INDICATOR (BLDTBS)
C     MCL   = FIELD INDEX OF CONTROL STREAMLINE (PTMOVE,FLOBAL)
      COMMON /CHDATA/ X1(1),LNEXT(1),MLB(1),MUB(1),PRIM(1),
     1               TYPELB(1),NAMELB(1),ILB(1),FLB(1),S1LB(1),
     1               TYPEUB(1),NAMEUB(1),IUB(1),FUB(1),S1UB(1),
     &               VMB(1),DWDV(1),X2CL(1),SLSWI(1),MCL(1),
     &               ANGTE(1),PTTE(1),PSTE(1),FGRTE(1),RGTE(1),
     &               ANGEXP(1),BSQEXP(475)
       DIMENSION     CRVLE(1),ANGLE(1)
       EQUIVALENCE   (SCHOKE,DWDV),(CRVLE,ANGTE),(ANGLE,PTTE)
       INTEGER       PRIM,TYPELB,TYPEUB,SCHOKE(1)
C    BOUNDARY TABLE
C     INDEX- LB=LBDO,LBDE
C     LBNEXT= INCREMENT TO NEXT BOUNDARY
C     LBZ1  = INCREMENT TO THE FIRST BOUNDARY POINT (=0 BEFORE COALLATIO
C     CHNAME= CHANNEL WITH WHICH THE BOUNDARY DATA IS ASSOCIATED
C     UP    = T OR F FOR UPPER OR LOWER BOUNDARY
C     LEDEX = RELATIVE INDEX OF L.E. POINT WHEN LOWER AND UPPER SURFACE
C             CONTOURS ARE CONNECTED
C     BDNAME,LBA,LBB=NAME AND INDEX LIMITS OF SPECIFIC BOUNDARY
C                    DATA WHEN BOUNDARIES ARE COALLATED
       DIMENSION     BDT(1),LBNEXT(1),LBZ1(1),
     1               CHNAME(1),UP(1),LEDEX(1),
     2               ZBT(1),RBT(1),ANGBT(42)
       LOGICAL       UP
       INTEGER BDT,CHNAME,BDNAME
       DIMENSION     BDNAME(1),LBA(1),LBB(1)

       DIMENSION     CHNAM(1),LHNEXT(1)
       INTEGER        CHNAM
       EQUIVALENCE   (X1,BDT,CHNAM), (LNEXT,LBNEXT,LHNEXT), (MLB,LBZ1),
     1               (MUB,CHNAME), (PRIM,UP), (TYPELB,LEDEX),
     2               (NAMELB,ZBT,BDNAME), (ILB,RBT,LBA), (FLB,ANGBT,
     3               LBB)

       COMMON /IXORIG/ LHO,LHE, LBDO,LBDE, LTO,LTE, LWO,LWE, LFO,LFE,
     *               LO,LESTA,  LDUM(8),
     *               MO,NM, NJ,NFCOLS, MAXNJ,MAXOL,MAXNM,MAXLE,
     *               LEO,LEE, LRO,LRE,LRD
       DIMENSION     LIMITS(24)
       EQUIVALENCE   (LIMITS,LHO)

       COMMON /CFRFIN/ ATINF,MINF,RFFREF,UINF,ZDN1,ZDN25
       REAL               MINF
       COMMON /CIDEX / M,J,MU,MD,ISTAG
       COMMON /CISBOT/ FARFLD(2),FREE(2),PRES(2),RFF,NZP,
     1               ZP(10),PPS(10), A1,A2,ADUM(6)
       INTEGER       FARFLD,FREE,PRES
       COMMON /TROUBL/ ERR,ERRMAJ,INERR,PRERR
       LOGICAL       ERR,ERRMAJ,INERR,PRERR

       LOGICAL       ONCE,SETAG
```

```
      DATA KLE/2HLE/, KTE/2HTE/, KFIELD/5HFIELD/
      DATA KFAR/6HFARFLD/, KFREE/4HFREE/, KPRES/4HPRES/, KSOLID/5HSOLID/
      DATA ONCE/.FALSE./
C     CHECK FOR INCORRECT CHANNEL INPUT NAMES
      LH     = LHO
      GO TO 45
C     LOOP THROUGH BOUNDARY TABLE TO SEE IF CHNAM(LH) IS REFERENCED
   32 LB     = LBDO
   35 IF(CHNAM(LH).EQ.CHNAME(LB) .OR. CHNAM(LH).EQ.CHNAME(LB+1))GO TO 40
      LB     = LB+LBNEXT(LB)
      IF(LB.LT.LBDE) GO TO 35
C      NO REFERENCE FOUND FOR CHNAM(LH)
      ERR    = .TRUE.
      WRITE (6,1035) CHNAM(LH)
 1035 FORMAT(57H *** ERROR - BOUNDARY INPUT DATA DOES NOT REFERENCE CHN
     1=,A6)
C     INDEX TO NEXT CHANNEL
   40 LH     = LH+LHNEXT(LH)
   45 IF(LH.LT.LHE) GO TO 32

C     LOOP THROUGH STATION TABLE TO INSERT SPECIAL BOUNDARY TYPES
      L      = LO

C      LOWER BOUNDARY
  100 NAMB   = NAMELB(L)
      KTYPE  = TYPELB(L)
      ITVL   = ILB(L)
      IRET   = 0
      GO TO 500
  150 TYPELB(L)=KTYPE
      IF(KTYPE.NE.KSOLID) NAMELB(L)=NAMB

C      UPPER BOUNDARY
      NAMB   = NAMEUB(L)
      KTYPE  = TYPEUB(L)
      ITVL   = IUB(L)
      IRET   = 1
      GO TO 500
  250 TYPEUB(L)=KTYPE
      IF(KTYPE.NE.KSOLID) NAMEUB(L)=NAMB

C     INDEX TO NEXT STATION
      L      = L+LNEXT(L)
      IF(L.LT.LESTA) GO TO 100
      RETURN

C**   GENERAL LOGIC FOR EITHER UPPER OR LOWER BOUNDARY
C     NAMB   = BOUNDARY NAME
C     KTYPE  = BOUNDARY TYPE
  500 IF(KTYPE.EQ.KLE .OR. KTYPE.EQ.KTE .OR. KTYPE.EQ.KFIELD)
     * GO TO 599

C     CHECK BOUNDARY TABLE TO FIND SEGMENT NAME IF TYPE=SOLID.
      SETAG  = .FALSE.
      LB     = LBF(NAMB)
      NAMBD  = NAMB
      IF(KTYPE.NE.KSOLID) GO TO 520
      LBXN   = LBZ1(LB)
      IF(LBXN.EQ.0) GO TO 520
```

```
      LBX    = LBZ1(LB)+3*ITVL-3
C     LBX    = INDEX (RELATIVE TO SUBTABLE ORIGIN) OF THE
C              INTERVAL OF THE OL-BOUNDARY INTERSECTION POINT
      LB1    = LB
  510 IF(LBA(LB1).LE.LBX .AND. LBB(LB1).GE.LBX) GO TO 515
      LB1    = LB1+3
      IF(LB1.LT.(LB+LBZ1(LB))) GO TO 510
      CALL ERROR1
C       CHECK FOR FIRST OF DOUBLE POINTS ON UPPER BOUNDARY
  515   IF(IRET.EQ.0 .OR. LBX.NE.LBB(LB1) .OR. (LB1+3).GE.(LB+LBZ1(LB))
     *   .OR. LBA(LB1+3).NE.(LBB(LB1)+3)) GO TO 518
C       CHANGE STATION-TABLE REFERENCE TO THE 2ND PT (1ST STREAMWISE PT)
      NAMBD = BDNAME(LB1)
        LB1    = LB1+3
      IUB(L)=IUB(L)+1
        SETAG = .TRUE.
  518 NAMB   = BDNAME(LB1)

C     DETERMINE IF GIVEN BOUNDARY NAME HAS BEEN SPECIFIED BY
C      USER INPUT AS A SPECIAL BOUNDARY TYPE
  520 IF(NAMB.EQ.FARFLD(1) .OR. NAMB.EQ.FARFLD(2)) KTYPE=KFAR
      IF(NAMB.EQ.FREE(1) .OR. NAMB.EQ.FREE(2)) KTYPE=KFREE
      IF(NAMB.EQ.PRES(1) .OR. NAMB.EQ.PRES(2)) KTYPE=KPRES

C     SET ISTAG EQUAL TO ZERO AT THE SOLID/FREE BREAK POINT
      IF(.NOT.SETAG .OR. (NAMBD.NE.FREE(1) .AND. NAMBD.NE.FREE(2) .AND.
     *   NAMBD.NE.PRES(1) .AND. NAMBD.NE.PRES(2))) GO TO 530
      M      = MUB(L)
      CALL GETIX
      ISTAG = 0
      CALL SAVIX

C     FAR-FIELD BOUNDARY GEOMETRIC DATA
  530 IF(KTYPE.NE.KFAR .OR. ONCE) GO TO 599
      LB1    = LB+LBZ1(LB)
      LB2    = LB+LBNEXT(LB)-9
      RFFREF= RBT(LB2)
      ZDN1   = ZBT(LB2)
      ZDN25  = ZBT(LB1)
      WRITE (6,1530) RFFREF,ZDN1,ZDN25,NAMB
 1530 FORMAT(//2X,41HTHE FAR FIELD INTERFACE BOUNDARY IS AT R=,F9.3,
     *11H BETWEEN Z=,F9.3,4H AND,F9.3,1H,,8H   (BDY=,A6,1H))

C     SET UP FAR FIELD SOLUTION MATRIX
      CALL FRFDNZ
      ONCE   = .TRUE.

C     RETURN
  599 IF(IRET) 150,150,250
      END
```

```
*DECK MATINV
      SUBROUTINE MATINV(YIJ,N,UNIT,M,DET,IN1,IN2,ND,IF)
CMATINV          DUMMY (CDC) MATINV SIMULATOR
      DIMENSION YIJ(1),UNIT(1),IN1(1),IN2(1)
      NN     = N*N
      CALL SETM(1,0.,UNIT,NN)
      N1     = N+1
      DO 1 L=1,NN,N1
    1 UNIT(L)= 1.
      CALL LRMDS1(YIJ,N,IN1,IN2,DET,IF,N)
      IF( DET.EQ.0. ) CALL ERROR1
      CALL DBSRT1(UNIT,N,IN1,IN2,YIJ,N,N)
    2 RETURN
      END
```

```
*DECK DUP1
      SUBROUTINE LFIT2D(X,Y,TO,NXY)
*LFIT2D          LINEAR SURFACE INTERPOLATION                        *LFIT2D*
C                IN A RECTANGULAR GRID
      DIMENSION        X(2),Y(2),TO(2)

C     INPUT-
C      X,Y    = LIST OF COORDINATES AT WHICH INTERPOLATED VALUES ARE TO BE
C      NXY    = NO OF COORDINATE POINTS

C      NXT    = NUMBER OF XT
C      NYT    = NUMBER OF YT
C      XT     = X-GRID OF T-TABLE
C      YT     = Y-GRID OF T-TABLE
C      T      = TABLE OF VALUES
C      NOTE   = NUMBER OF T-VALUES IS NXT*NYT. ORDER IS ILLUSTRATED BELOW
C         YT(NYT)*  T(3)       T(6)       T(NXT*NYT)
C         YT(2)  *  T(2)       T(5)       T(8)
C         YT(1)  *  T(1)       T(4)       T(7)
C                ---*----------*----------*---------
C                   XT(1)      XT(2)      XT(NXT)

C     OUTPUT-
C      TO     = INTERPOLATED VALUES AT X,Y

      COMMON /CTHICK/ NXT,NYT,XT(20),YT(20),T(78)
      COMMON /ERASE / DUM(400),T1(200),T2(200)

C      FIND CORRECT X-INTERVAL
      I       = 1
      M       = 1
      ISV     = 0
  100 NCOUNT= 0
  105 IF(X(M).LT.XT(I)) GO TO 110
      IF(X(M).GT.XT(I+1)) GO TO 120
      F       = (X(M)-XT(I))/(XT(I+1)-XT(I))
      GO TO 150
  110 IF(I.EQ.1) GO TO 140
      I       = I-1
      GO TO 125
  120 IF((I+1).GE.NXT) GO TO 145
      I       = I+1
  125 NCOUNT= NCOUNT+1
      IF(NCOUNT.GT.NXT) CALL ERROR1
      GO TO 105
  140 F       = 0.
      GO TO 150
  145 F       = 1.

C      INTERPOLATE WRT Y
  150 IF(I.EQ.ISV) GO TO 160
      IJ2     = I*NYT+1
      IJ1     = IJ2-NYT
      CALL LFIT1(YT,T(IJ1),NYT, Y,T1,NXY)
      CALL LFIT1(YT,T(IJ2),NYT, Y,T2,NXY)
      ISV     = I

C      INTERPOLATE WRT X
  160 TO(M) = F*T2(M)+(1.-F)*T1(M)

      M       = M+1
      IF(M.LE.NXY) GO TO 100
```

```
C...  END LOOP FOR INTERPOLATIONG TO(M) AT X(M),Y(M),M=1,NXY
      RETURN
      END
```

```
*DECK DUP2
      SUBROUTINE TTPT(MA,MB, WSTA,DISP,WAKE,TT,PT,LAM,RGX,C2CPX,FGRX)
*TTPT-=          TT, PT, AND RCU FOR STREAMLINES                   @TTPT@
       LOGICAL                                WAKE
       REAL                                                    LAM(25)
       DIMENSION WSTA(25),DISP(25),TT(25),PT(25),
     1           RGX(25),C2CPX(25),FGRX(25)


C     INPUT-
C      MA     = FIRST FIELD POINT
C      MB     = LAST FIELD POINT

C     OUTPUT-
C      WSTA   = LIST OF STREAM FUNCTION VALUES
C      DISP(K)=NON-ZERO FOR POSSIBLE SLIP CONDITION BETWEEN STREAMLINE
C              K AND K+1.  OTHERWISE DISP(K)=0.
C             = DISPLACEMENT THICKNESS OF WAKE IF POSITIVE
C      WAKE   = .TRUE. IF THERE EXISTS ANY WAKE DISPLACEMENTS.
C      TT     = INTERPOLATED TOTAL TEMPERATURE
C      PT     = INTERPOLATED TOTAL PRESSURE
C      LAMBDA= LAMINA THICKNESS IN THIRD DIMENSION.  BLOCKAGE EFFECT
C      RCU    = INTERPOLATED ANGULAR MOMENTUM              ***NOT NOW IN USE
C      RGX    = GAS CONSTANT
C      C2CPX  = SPECIFIC HEAT
C      FGRX   = 1./(GAM-1.)= FUNCTION OF GAMMA FOR CALCULATING DENSITY
C      NOTE - LENGTH OF WSTA,TT,PT,RCU-LISTS IS MB-MA+1

C    WAKETB, CONVTB, CADJWF
C     TABLE OF CONVECTED PROPERTIES
C      INDEX- LT=LTO,LTE
      COMMON /CHDATA/ CH(1),LTNEXT(1),NPT(1),LPSI(1),LTT(1),LPT(1),
     1                LRCU(1),
     2                CRG(1),CPGJ(1),C2CP(1),QGAM(1),FGT(1),FGP(1),
     3                FGR(1),AREATB(485)
       INTEGER CH
      DIMENSION XCH(1)
      EQUIVALENCE (CH,XCH)
*   SEE OTHER LISTING OF TTPT FOR EXPLANATION OF VARIABLES
C     FLOW ADJUSTMENT TABLE
C      INDEX- LF=LFO,LFE
       DIMENSION        X1F(1),X2F(1),X1BF(1),X1AF(1),
     1                  S1F(1),NCHB(1),NCHA(1),JORDER(1),VNR(12)
       EQUIVALENCE      (LFB,X1BF),(LFA,X1AF),(LRF,NCHB),(LRXF,NCHA)
       DIMENSION        LFB(1),LFA(1),LRF(1),LRXF(1)
C     TABLE OF WAKE DISPLACEMENT THICKNESS
C      INDEX- LW=LWO,LWE
       DIMENSION                X2W(1),LWNEXT(1),S1W(47)
       DIMENSION        DST(1)
       EQUIVALENCE      (DST,S1W)
C      SUBTABLE ARRANGEMENT IS-
C       X2W,LWNEXT(=2+2N), S1W(1),S1W(2),..S1W(N), DST(1),DST(2),..DST(N)
C      X2W    = STREAMLINE COORDINATE
C      S1W    = DISTANCE ALONG STREAMLINE FROM T.E.
C      DST    = WAKE DISPLACEMENT THICKNESS AS A FUNCTION OF S1W
       EQUIVALENCE      (CH,X1F,X2W), (LTNEXT,X2F,LWNEXT), (NPT,X1BF,S1W)
       EQUIVALENCE      (LPSI,X1AF), (LTT,S1F), (LPT,NCHB), (LRCU,NCHA)
       EQUIVALENCE      (CRG,JORDER), (CPGJ,VNR)
C
      COMMON /IXORIG/ LHO,LHE, LBDO,LBDE, LTO,LTE, LWO,LWE, LFO,LFE,
     *                LO,LESTA,  LDUM(8),
     *                MO,NM, NJ,NFCOLS, MAXNJ,MAXOL,MAXNM,MAXLE,
```

```
     *                    LEO,LEE, LRO,LRE,LRD
      DIMENSION           LIMITS(24)
      EQUIVALENCE         (LIMITS,LHO)
      COMMON /SLTAB / W(128),X2(128),SLCHN(128)
      INTEGER SLCHN
      COMMON /CIDEX / M,J,MU,MD,ISTAG
      COMMON /CMAXIT/ MAXIT,MAJCTR,GREFIN,EDUM
      COMMON /CPTMOV/ VELPOT,ICOB,NODENS,CPTDUM
      COMMON /CR    / R(300)
      COMMON /CS1   / S1(300)
      COMMON /CTHICK/ NTHKX,NTHKY,THKX(20),THKY(20),THIK2D(78)
      COMMON /CZ    / Z(300)
      COMMON /ERASE / PSI(800)

      INTEGER             CHX

C     INTERPOLATE FOR LAMINA THICKNESS
      NK      = MB-MA+1
      CALL SETM(1,1., LAM,NK)
      IF(NTHKX.LE.1) GO TO 100
      CALL LFIT2D(Z(MA),R(MA),LAM,NK)

C     INITIALIZE
  100 WAKE    = .FALSE.

C     DEFINE NUMBER OF STREAMLINES,  NK,  ASSOCIATED WITH EACH CHANNEL
      K       = 1
      M       = MA
      WADD    = 0.
  105 NK      = 0
      K1      = K
      M1      = M
  110 CALL GETIX
      IF(M,NE.M1) GO TO 114
      CHX     = SLCHN(J)
      PSI1    = X2(J)
  114 IF(SLCHN(J).RE.CHX) GO TO 120
      NK      = NK+1
      DISP(K)=0.
      WSTA(K)=W(J)$WADD
      PSI(NK)=X2(J)
      K       = K+1
      M       = M+1
      IF(M,LE.MB) GO TO 110

C     FIND INDEX IN CONVTB
  120 LT      = LTO
  125 IF(LT.GT.LTE) CALL ERROR1
      IF(CH(LT).EQ.CHX) GO TO 130
      LT      = LT+LTNEXT(LT)
      GO TO 125

C     INTERPOLATE FOR CONVECTED PROPERTIES
C     SCALE THE PSI TABLE TO CONFORM TO THE LPSI-TABLE IN /CONVTB/
  130 NI      = NPT(LT)
      I       = LT+LPSI(LT)
      I2      = I+NI
      IF(K1.EQ.1 .AND. NK.EQ.1) PSI1=PSI1-8.
      PSI1    = 8.*AINT(PSI1/8.)
      F       = XCH(I2-1)/8.
      DO 140 KN=1,NK
```

```
  140 PSI(KN)=(PSI(KN)-PSI1)*F
      IT     = LT+LTT(LT)
      IP     = LT+LRT(LT)
      IS     = LT+LRCU(LT)
      CALL LSPFIT(CH(I),CH(IT),NI, PSI,TT(K1),NK, 0)
      CALL LSPFIT(CH(I),CH(IP),NI, PSI,PT(K1),NK, 0)
C     CALL LSPFIT(CH(I),CH(IS),NI, PSI,RCU(K1),NK, 0)
      CALL SETM(1,CRG(LT),RGX(K1),NK)
      CALL SETM(1,C2CP(LT),C2CPX(K1),NK)
      CALL SETM(1,FGR(LT),FGRX(K1),NK)

C     WAKE DISPLACEMENT THICKNESS
C     SEARCH FOR X2-SUBTABLE
      IF(M.GT.MB) GO TO 200
      X2J    = X2(J)
      DISP(K-1)=-1.
      LW     = LWO
  155 IF(LW.GE.LWE) GO TO 190
      IF(X2W(LW).EQ.X2J) GO TO 170
      LW     = LW+LWNEXT(LW)
      GO TO 155
C     FIND TRAILING EDGE S1 IN THE FLOW ADJUSTMENT TABLE, S1F
  170 LF     = LFO
  175 IF(X2F(LF).EQ.X2J) GO TO 180
      LF     = LF+NFCOLS
      IF(LF.LT.LFE) GO TO 175
      CALL ERROR1
C     INTERPOLATE FOR WAKE DISPLACEMENT THICKNESS, DSTAR
  180 S1FTE=S1(M)-S1F(LF)
C      S1-FROM-T.E.
      IF(S1FTE.LE.0.) GO TO 190
      N      = (LWNEXT(LW)-2)/2
      LSTAR = LW+N
      CALL LSPFIT(S1W(LW),DST(LSTAR),N, S1FTE,DISP(K-1),1, 0)
      IF(DISP(K-1)) 184,184,186
  184 DISP(K-1)=-1.
      GO TO 190
  186 WAKE   = .TRUE.

C     LOOP FOR NEXT CHANNEL
  190 WADD   = WSTA(K-1)
      GO TO 105

C     USE CONSTANT DENSITY APPROXIMATION FOR  MAJCTR.LE.NODENS
  200 IF(MAJCTR.LE.NODENS) CALL SETM(1,0.,FGRX,K-1)
      RETURN
      END
```

```
*DECK BUILDS
      OVERLAY(STC,1,3)
      PROGRAM BUILDS
C
C     FLOW ADJUSTMENT TABLE
C      INDEX- LF=LFO.LFE
      COMMON /CHDATA/ X1F(1),X2F(1),X1BF(1),X1AF(1),
     1                S1F(1),NCHB(1),NCHA(1),JORDER(1),VNR(12)
      EQUIVALENCE     (LFB,X1BF),(LFA,X1AF),(LRF,NCHB),(LRXF,NCHA)
      DIMENSION       LFB(1),LFA(1),LRF(1),LRXF(1)
      DIMENSION TABLES(10)
      EQUIVALENCE (TABLES(1),X1F(1))
C
      COMMON /CLWOSV/ LWOSV
      COMMON /IXORIG/ LHO,LHE, LBDO,LBDE, LTO,LTE, LWO,LWE, LFO,LFE,
     *                LO,LESTA,  LDUM(8),
     *                MO,NM, NJ,NFCOLS, MAXNJ,MAXOL,MAXNM,MAXLE,
     *                LEO,LEE, LRO,LRE,LRD
      DIMENSION       LIMITS(24)
      EQUIVALENCE     (LIMITS,LHO)

      COMMON /SELECT/ LENTRY

      GO TO (5,10), LENTRY
    5 CALL BLDTBS
      GO TO 20
C     REBUILD CONVECTED PROPERTIES TABLE AND REPACK IF RESTRT=T.
   10 CALL RBCONV
      NMOVE1= LTE-LBDO+1
      LWTO   = LHE+1+NMOVE1
      CALL MOVE(2, TABLES(LBDO),TABLES(LHE+1),NMOVE1,1,
     1             TABLES(LWO),TABLES(LWTO),LESTA-LWOSV+1,1)
      MOVE1  = LHE+1-LBDO
      LBDO   = LBDO+MOVE1
      LBDE   = LBDE+MOVE1
      LTO    = LTO+MOVE1
      LTE    = LTE+MOVE1
      LWO    = LWTO
      MOVE2  = LWO-LWOSV
      LWE    = LWE+MOVE2
      LFO    = LFO+MOVE2
      LFE    = LFE+MOVE2
      LO     = LO+MOVE2
      LESTA  = LESTA+MOVE2

C     SET FLOW ADJUSTMENT ITERATION COUNTER TO ZERO
      LF     = LFO
  850 IF(LF.GE.LFE) GO TO 20
      VNR(LF)= 0.
      LF     = LF+NFCOLS
      GO TO 850

   20 RETURN
      END
```

```
*DECK BCONV
      SUBROUTINE BCONV(CHTA,LTA,AREA)
*BCONV*          BUILD CONVECTED PROPERTIES TABLE                      *BCONV*
        INTEGER          CHTA

C      INPUT-
C       CHTA   = CHANNEL NAME
C       AREA   = FLOW AREA IN CASE NO /CHDATA/ IS AVAILABLE
C       DATA IN THE CHANNEL DATA TABLE. /CHDATA/

C      OUTPUT-
C       LTA    = INDEX OF CHTA IN CONVTB
C       SUBTABLE OF CONVECTED FLOW PROPERTIES
C       DETERMINATION OF CHANNEL FLOW RATE

C      OUTPUT FOR FAR FIELD CALCULATION
C       ATINF  = SPEED OF SOUND AT STAGNATION TEMPERATURE
C       MINF   = FREE STREAM MACH NUMBER
C       UINF   = FREE STREAM VELOCITY

C     CHDATA, CONVTB
C      CHANNEL INPUT DATA TABLE
C       INDEX- LH=LHO,LHE
C      TABLE OF CONVECTED PROPERTIES
C       INDEX- LT=LTO,LTE
C       CH     = CHANNELNAME
C       LTNEXT= INDEX INCREMENT TO THE NEXT CHANNEL
C       LPSI   = RELATIVE LOCATION OF PSI LIST
C       NPT    = NO. OF PSI, TT, PT AND RCU VALUES
C       LTT    = RELATIVE LOCATION OF TT LIST
C       LPT    = RELATIVE LOCATION OF PT LIST
C       LRCU   = RELATIVE LOCATION OF RCU LIST
       COMMON /CHDATA/ CHNAM(1),LHNEXT(1),WTFLOW(1),TTO(1),PTO(1),
     1                 TSO(1),PSO(1),MACHO(1),AO(1),VARY(1),
     2                 RG(1),GAM(1), NR(1),NC(1),TAB(6),
     4                 BB(75)
        LOGICAL        VARY
        INTEGER CHNAM
        DIMENSION      VO(1)
        REAL           MACHO
        EQUIVALENCE    (VO,MACHO)
       DIMENSION       CH(1),LTNEXT(1),NPT(1),LPSI(1),LTT(1),LPT(1),
     1                 LRCU(1),
     2                 CRG(1),CPGJ(1),C2CP(1),QGAM(1),FGT(1),FGP(1),
     3                 FGR(1),AREATB(485)
        INTEGER CH
       DIMENSION XCH(1)
       EQUIVALENCE (CH,XCH)
        EQUIVALENCE   (CHNAM,CH),(LHNEXT,LTNEXT),(WTFLOW,NPT),
     &                (TTO,LPSI),(PTO,LTT),(TSO,LPT),(PSO,LRCU),
     &                (MACHO,CRG),(AO,CPGJ),(VARY,C2CP),
     &                (RG,QGAM),(GAM,FGT),(NR,FGP),(NC,FGR),
     &                (TAB,AREATB)
C
       COMMON /ALLCOM/ MACHA,PSA,TSA,PTA,TTA, AXIA,RGA,GAMA,
     1                 MACHC,PSC,TSC,PTC,TTC, AXIC,RGC,GAMC,
     2                 DAXIT,SCALEA,TTE,CHOTST
        REAL           MACHA(1),MACHC
        LOGICAL        AXIA,AXIC,CHOTST
       COMMON /IXORIG/ LHO,LHE, LBDO,LBDE, LTO,LTE, LWO,LWE, LFO,LFE,
     *                 LO,LESTA,  LDUM(8),
     *                 MO,NM, NJ,NFCOLS, MAXNJ,MAXOL,MAXNM,MAXLE,
```

```
     *                  LEO,LEE, LRO,LRE,LRD
       DIMENSION        LIMITS(24)
       EQUIVALENCE      (LIMITS,LHO)

      COMMON /CBITS / BITS,BLANK
      COMMON /CFRFIN/ ATINF,MINF,RFFREF,UINF,ZDN1,ZDN25
       REAL                   MINF
      COMMON /CGRAV / CG
      COMMON / CNORM / RHL,RM,AHL,ARM
      COMMON /CPI   / PI,TWOPI,PIO2,PIO4,TODEG,TORAD
      COMMON /CQIREM/ YTOL,YO,DYDX,CTRMAX
      COMMON /CTAPOS/ RESTRT,ENDBDT,ENDFIL,K6SV
       LOGICAL          RESTRT,ENDBDT,ENDFIL
      COMMON /ERASE/   EDUM(72),QV(8), A(90),V(90),
     1                 PSI(90),R(90),TT(90),PT(90),RCU(90),PS(90)
       DIMENSION        Y(90)
       EQUIVALENCE      (Y,R)
      COMMON /TROUBL/  ERR,ERRMAJ,INERR,PRERR
       LOGICAL          ERR,ERRMAJ,INERR,PRERR

       INTEGER          CHT,EXT

      DATA EXT/3HEXT/

      CHT    = CHTA
      CALL SETM(1,BITS, PSI,540)
      CALL RTCFI(CHT,LH)

C     DEFINE GAS PROPERTIES
      LT     = LTE+1
      LTE    = LTE+15
      QGAM(LT)=0.
      FGR(LT)=0.
      FGP(LT)=1.
      FGT(LT)=1.
      GAMMA = GAMA
      IF(LH.NE.0 .AND. GAM(LH).NE.BITS) GAMMA=GAM(LH)
      IF(GAMMA.EQ.0.) GO TO 85
      FG1    = GAMMA-1.
      FGR(LT)=1./FG1
      FGP(LT)=GAMMA*FGR(LT)
      FGT(LT)=FG1/GAMMA
      QGAM(LT)=1./GAMMA

   85 CRG(LT)=RGA
      IF(LH.NE.0 .AND. RG(LH).NE.BITS) CRG(LT)=RG(LH)
      CPGJ(LT)=FGP(LT)*CRG(LT)
      C2CP(LT)=2.*CPGJ(LT)

C     DEFINE TOTAL PROPERTIES AS DETERMINED FROM DATA ON
C       STC/SHEET-1 OF INPUT
      TTC    = TTA
      PTC    = PTA
      PSC    = PSA
      IF(GAMA.EQ.0.) GO TO 95
      FG2    = GAMA-1.
      FGRA   = GAMA/FG2
      GO TO 97
   95 FG2    = 1./(TSA*RGA)
      FGRA   = 1.
   97 IF(MACHA.EQ.BITS) GO TO 99
```

```
      TTQTS = 1.+.5*FG2*MACHA*MACHA
      TTC   = TSA*TTQTS
      PTC   = PSA*TTQTS**FGRA
      TSC   = TSA
      GO TO 100
   99 TSC   = TTC*(PSC/PTC)**(1./FGRA)
      TTQTS = TTC/TSC
      MACHC = SQRT(2.*(TTQTS-1.)/FG2)

C     NUMBER OF INPUT STREAMLINES, GIVEN FLOW RATE.
  100 NSL   = 1
      WTF   = 0.
      IF(LH.EQ.0) GO TO 150
      NSL   = NR(LH)
      IF(WTFLOW(LH).NE.BITS) WTF=WTFLOW(LH)/CG

C     NO INPUT PROFILES
      IF(NSL.NE.0) GO TO 150
      TT    = TTC
      PT    = PTC
      IF(TTO(LH).NE.BITS) TT=TTO(LH)
      IF(PTO(LH).NE.BITS) PT=PTO(LH)
      NSL   = 1

C     FILL PS, PT, TT AND RCU TABLES
  150 IF(TT.EQ.BITS) TT=TTC
      IF(PT.EQ.BITS) PT=PTC
      IF(RCU.EQ.BITS) RCU=0.
      IF(PSI.EQ.BITS) GO TO 160
      CALL FILL(PSI,PT,1,NSL)
      CALL FILL(PSI,TT,1,NSL)
      CALL FILL(PSI,RCU,1,NSL)
      IF(WTF.EQ.0.) GO TO 250
      CONST = WTF/PSI(NSL)
      DO 155 J=1,NSL
  155 PSI(J)= CONST*PSI(J)
      GO TO 250

  160 IF(R.EQ.BITS) GO TO 190
      CALL FILL(R,PT,1,NSL)
      CALL FILL(R,TT,1,NSL)
      CALL FILL(R,RCU,1,NSL)
      IF(PS.NE.BITS) CALL FILL(R,PS,1,NSL)

C     INTEGRATION OF RHO*V*DA
      IF(NSL.EQ.1) GO TO 190
      IF(PS.EQ.BITS .AND. WTF.EQ.0.) CALL ERROR1
      IF(AXIA) GO TO 170
      DO 165 J=1,NSL
  165 A(J)    = Y(J)
      GO TO 173
  170 DO 172 J=1,NSL
  172 A(J)   = PI*R(J)*R(J)
  173 PTMIN = PT(1)
      DO 174 J=2,NSL
      PTMIN = AMIN1(PTMIN,PT(J))
  174 IF(A(J).LT.A(J-1)) ERR=.TRUE.
      IF(ERR) GO TO 182

  175 QV    = 0.
  176 IF(PS.EQ.BITS) GO TO 177
```

```
      YTOL   = 1.E6
      GO TO 179
  177 PS(1) = .95*PTMIN
      YTOL   = WTF*1.E-5
  178 CALL SETM(1,RS, PS(2),NSL-1)
  179 DO 180 J=1,NSL
      TS     = TT(J)*(PS(J)/PT(J))**FGT(LT)
      IF(TS.GE.TT(J)) GO TO 185
      V(J)   = SQRT(C2CP(LT)*(TT(J)-TS))*PS(J)/(CRG(LT)*TS)
  180 CONTINUE
      PSI(1)= 0.
      CALL LSPFIT(A,V,NSL, A,PSI,NSL, -1)

      DELP   = PTMIN-PS(1)
      XJP    = .5*DELP
      DYDX   = -.5*PSI(NSL)/DELP
      YO     = WTF
      CALL QIREM(PS,PSI(NSL),XJP,QV)
      IF(QV.GE.2. .AND. QV(5).EQ.0.) GO TO 183
      IF(QV.EQ.21.) GO TO 184
      IF(QV.NE.0.) GO TO 178
C      *MACHC AND TSC FOR FAR FIELD CALCULATION (RARE OPTION)
       MACHC = V(NSL)/SQRT(GAMMA*CRG(LT)*TS)
       TSC    = TS
      GO TO 250

C    ERROR COMMENTS
  182 WRITE (6,1182) CHT
      GO TO 187
  183 PSIMAX= PSI(NSL)*CG
      WRITE (6,1183) CHT,WTFLOW(LH),PSIMAX
      GO TO 186
  184 WRITE (6,1184) WTF,CHT
      GO TO 186
  185 WRITE (6,1185) CHT
  186 CALL TABPRT(2HQV,QV,8,8)
      CALL TABPRT (6HCQIREM,YTOL,4,4)
      CALL TABPRT(3HPSI,PSI,NSL,10)
  187 ERR    = .TRUE.
      CALL TABPRT(2HPS,PS,NSL,10)
      CALL TABPRT(2HPT,PT,NSL,10)
      CALL TABPRT(2HTT,TT,NSL,10)
      CALL TABPRT(4HAREA,A,NSL,10)
      GO TO 250

C    GIVEN MACH NUMBER, AREA AND STATIC FLOW PROPERTIES
  190 IF(WTF.NE.0. .AND. (LH.EQ.0 .OR. MACHO(LH).EQ.BITS)) GO TO 200
      MACHC = MACHA
      IF(LH.EQ.0) GO TO 195
      IF(MACHO(LH).NE.BITS) MACHC=MACHO(LH)
      IF(PSO(LH).NE.BITS) PSC=PSO(LH)
      IF(TSO(LH).NE.BITS) TSC=TSO(LH)
  195 IF(QGAM(LT).EQ.0.) FG1=1./(TSC*CRG(LT))
      TTQTS  = 1.+0.5*FG1*MACHC*MACHC
  196  IF(LH.EQ.0 .OR. (TTO(LH).EQ.BITS .AND. PTO(LH).EQ.BITS)) GOTO 197
C      *TOTAL CONDITIONS ARE SPECIFIED RATHER THAN STATIC
       TSC    = TT/TTQTS
       RSC    = PT/TTQTS**FGP(LT)
       GO TO 198
  197 TT     = TSC*TTQTS
      PT     = PSC*TTQTS**FGP(LT)
```

```
198 IF(WTF.NE.0.) GO TO 240
    IF ( LH.NE. 0 .AND. AO(LH).NE.BITS ) AREA=AO(LH)*RHL
    IF ( LH.NE. 0 .AND. AO(LH).NE. BITS .AND. AXIA ) AREA=AO(LH)*PI
   * *RHL**2
    AREATB(LT)=AREA
    WTF    = PSC/(CRG(LT)*TSC)*AREA*MACHC
    IF(GAM(LT).NE.0.) WTF=WTF*SQRT(GAMMA*CRG(LT)*TSC)
    GO TO 240

C     GIVEN FLOW RATE + TOTAL/STATIC CONDITIONS FROM STC/SHEET-1
200 AREATB(LT)=0.
    IF(TSC.LT.TTC)
   *AREATB(LT)=WTF*CRG(LT)*TSC/(PSC*SQRT(C2CP(LT)*(TTC-TSC)))
210 AREA   = AREATB(LT)

240 PSI(NSL)=WTF
    IF(WTF.NE.0.) GO TO 250
    ERR    = .TRUE.
    WRITE (6,1200) CHT

C     PUT DATA IN CONVTB-ARRAY
250 CH(LT)= CHT
    NPT(LT)=NSL
    LT1    = LT+15
    CALL MOVE(1, PSI,CH(LT1),NSL,1)
    LPSI(LT)=LT1-LT
    LT1    = LT1+NSL
    CALL MOVE(1, TT,CH(LT1),NSL,1)
    LTT(LT)=LT1-LT
    LT1    = LT1+NSL
    CALL MOVE(1, PT,CH(LT1),NSL,1)
    LPT(LT)=LT1-LT
    LT1    =LT1+NSL
    CALL MOVE(1, RCU,CH(LT1),NSL,1)
    LRCU(LT)=LT1-LT
    LTNEXT(LT)=15+4*NSL
    LTE    = LT+LTNEXT(LT)-1

C     EXTERNAL CHANNEL PROPERTIES FOR FAR FIELD CALC
    IF(CHT.NE.EXT) GO TO 990
    ATINF = 1.E6
    IF(GAMMA.NE.0.) ATINF=SQRT(GAMMA*CRG(LT)*TT(NSL))
    MINF   = MACHC
    UINF   = MACHC*SQRT(GAMMA*CRG(LT)*TSC)

990 LTA    = LT
    RETURN
1185 FORMAT(/1X20H***  ERROR- FOR CHN=A6,1X53HTHE STATIC PRESSURE EXCEE
   *DS THE INPUT TOTAL PRESSURE.,8H(BCONV) )
1182 FORMAT(34H ***  ERROR- THE R (OR Y) FOR CHN=     ,A6,
   *35H MUST BE IN ASCENDING ORDER (BCONV)  )
1183 FORMAT(21H ***  ERROR- FOR CHN=     ,A6,31H THE INPUT FLOW RATE OF
   *WTFLOW=,F9.3,37H IS GREATER THAN THE CHOKED VALUE OF ,F8.3,
   *8H (BCONV)  )
1184 FORMAT(53H ***  ERROR- FAILURE OF PS-ITERATION GIVEN WTFLOW/CG=,
   *F9.4, 9H FOR CHN=   ,A6,8H (BCONV)  )
1200 FORMAT(/1X32HERROR- THE FLOW RATE FOR CHANNEL2X,A6,1X15HIS NOT DEF
   *INED.)
    END
```

```
*DECK BLDTBS
      SUBROUTINE BLDTBS
*BLDTBS         BUILD ORTHOGONAL/CHANNEL TABLE,                 @BLDTBS@
C               STREAMLINE TABLE, STATION TABLE,
C               FIELD TABLES AND FLOW ADJUSTMENT TABLE.

C     INPUT-
C      BOUNDARY TABLE. /BDYTAB/
C      CHANNEL INPUT DATE, /CHDATA/
C      ORDERED EDGE POINTS, /LETEPT/

C     OUTPUT-
C      LIST OF CHANNELS FOR EACH ORTHOGONAL. /ORTCHN/
C      TABLE OF CONVECTED PROPERTIES, /CONVTB/
C      STREAMLINE TABLE. /SLTAB/
C      STATION TABLE. /STATAB/
C      FIELD VALUES* /CZ/, /CR/, /CS2/, /CM/
C      TABLE OF STAS AT WHICH FLOW ADJUSTMENT MUST BE ACCOMPLISHED, /CADJ
C      TRAILING EDGE WAKE DISPLACEMENT THICKNESS TABLE, IF NOT CARD INPUT


C   COMALL
C    CHANNEL INPUT DATA TABLE
C      INDEX- LH=LHO,LHE
       DIMENSION         CHNAM(1),LHNEXT(1),WTFLOW(1),TTO(1),PTO(1),
     1                  TSO(1),PSO(1),MACHO(1),AO(1),VARY(1),
     2                  RG(1),GAM(1), NR(1),NC(1),TAB(6),
     4                  BB(75)
        LOGICAL         VARY
        INTEGER CHNAM
        DIMENSION       VO(1)
        REAL            MACHO
        EQUIVALENCE     (VO,MACHO)
C     BOUNDARY TABLE
C      INDEX- LB=LBDO,LBDE
C      LBNEXT= INCREMENT TO NEXT BOUNDARY
C      LBZ1  = INCREMENT TO THE FIRST BOUNDARY POINT (=0 BEFORE COALLATIO
C      CHNAME= CHANNEL WITH WHICH THE BOUNDARY DATA IS ASSOCIATED
C      UP    = T OR F FOR UPPER OR LOWER BOUNDARY
C      LEDEX = RELATIVE INDEX OF L.E. POINT WHEN LOWER AND UPPER SURFACE
C              CONTOURS ARE CONNECTED
C      BDNAME,LBA,LBB=NAME AND INDEX LIMITS OF SPECIFIC BOUNDARY
C                     DATA WHEN BOUNDARIES ARE COALLATED
       DIMENSION        BDT(1),LBNEXT(1),LBZ1(1),
     1                  CHNAME(1),UP(1),LEDEX(1),
     2                  ZBT(1),RBT(1),ANGBT(42)
        LOGICAL         UP
        INTEGER BDT,CHNAME,BDNAME
        DIMENSION       BDNAME(1),LBA(1),LBB(1)
        EQUIVALENCE     (BDNAME,ZBT), (LBA,RBT), (LBB,ANGBT)
C     TABLE OF CONVECTED PROPERTIES
C      INDEX- LT=LTO,LTE
C      CH     = CHANNELNAME
C      LTNEXT= INDEX INCREMENT TO THE NEXT CHANNEL
C      LPSI   = RELATIVE LOCATION OF PSI LIST
C      NPT    = NO. OF PSI, TT, PT AND RCU VALUES
C      LTT    = RELATIVE LOCATION OF TT LIST
C      LPT    = RELATIVE LOCATION OF PT LIST
C      LRCU   = RELATIVE LOCATION OF RCU LIST
       DIMENSION        CH(1),LTNEXT(1),NPT(1),LPSI(1),LTT(1),LPT(1),
     1                  LRCU(1),
     2                  CRG(1),CPGJ(1),C2CP(1),GGAM(1),FGT(1),FGP(1),
```

```
      3                    FGR(1),AREATB(485)
       DIMENSION           XCH(1)
       EQUIVALENCE         (CH,XCH)
C     TABLE OF WAKE DISPLACEMENT THICKNESS
C      INDEX= LW=LWO,LWE
      DIMENSION                     X2W(1),LWNEXT(1),S1W(47)
       DIMENSION           DST(1)
       EQUIVALENCE         (DST,S1W)
C      SUBTABLE ARRANGEMENT IS=
C       X2W,LWNEXT(=2*2N), S1W(1),S1W(2),..,S1W(N), DST(1),DST(2),..,DST(N)
C      X2W    = STREAMLINE COORDINATE
C      S1W    = DISTANCE ALONG STREAMLINE FROM T.E.
C      DST    = WAKE DISPLACEMENT THICKNESS AS A FUNCTION OF S1W
C     FLOW ADJUSTMENT TABLE
C      INDEX= LF=LFO,LFE
C      NFCOLS= 8
C      X1F    = ORTHOGONAL COORDINATE
C      X2F    = STREAMLINE COORDINATE OF SL EMINATING FROM T.E.
C      X1BF   = X1-COORDINATE OF CHOKE STATION OF FLOW BELOW T.E.
C      X1AF   = X1-COORDINATE OF CHOKE STATION OF FLOW ABOVE T.E.
C      S1F    = S1-COORDINATE OF T.E. (UPPER SURFACE). THIS ITEM
C               IS USED WHEN INTERPOLATING FOR WAKE DELTA-STAR.
C      LFB,LFA=INDICES OF STATIONS BELOW AND ABOVE T.E.
C      NCHB,NCHA=NUMBER OF CHANNELS BELOW AND ABOVE T.E.
C      LRF    = INDEX OF DUMMY ORTCHN LIST FOR THE T.E.
C      LRXF   = INDEX OF LAST CHANNEL BELOW THE T.E.
C      JORDER= 0 IF TOTAL FLOW AT X1F IS GIVEN
C            = 2 IF FLOW ABOVE T.E. IS GIVEN
C            = 1 IF FLOW BELOW T.E. IS GIVEN
C      JORDER= -1 IF FLOW AT X1F IS CHOKED AND SINGLE CHANNEL
      DIMENSION            X1F(1),X2F(1),X1BF(1),X1AF(1),
     1                     S1F(1),NCHB(1),NCHA(1),JORDER(1),VNR(12)
       EQUIVALENCE         (LFB,X1BF),(LFA,X1AF),(LRF,NCHB),(LRXF,NCHA)
       DIMENSION           LFB(1),LFA(1),LRF(1),LRXF(1)
C     STATION TABLE
C      INDEX= L=LO,LESTA
C      SCHOKE= STATION CHOKE INDICATOR (ADJWF,BRHS,WRIOUT)
C      MCL    = SHARP CORNER INDICATOR (BLDTBS)
C      MCL    = FIELD INDEX OF CONTROL STREAMLINE (PTMOVE,FLOBAL)
      COMMON /CHDATA/ X1(1),LNEXT(1),MLB(1),MUB(1),PRIM(1),
     1                 TYPELB(1),NAMELB(1),ILB(1),FLB(1),S1LB(1),
     1                 TYPEUB(1),NAMEUB(1),IUB(1),FUB(1),S1UB(1),
     &                 VMB(1),DWDV(1),X2CL(1),SLSWI(1),MCL(1),
     &                 ANGTE(1),PTTE(1),PSTE(1),FGRTE(1),RGTE(1),
     &                 ANGEXP(1),BSQEXP(475)
        DIMENSION          CRVLE(1),ANGLE(1)
        EQUIVALENCE        (SCHOKE,DWDV),(CRVLE,ANGTE),(ANGLE,PTTE)
        INTEGER            PRIM,TYPELB,TYPEUB,SCHOKE(1)
       EQUIVALENCE        (CHNAM,BDT,CH,X2W,X1F,X1)
       EQUIVALENCE        (LHNEXT,LBNEXT,LTNEXT,LWNEXT,X2F,LNEXT)
       EQUIVALENCE        (WTFLOW,LBZ1,NPT,S1W,X1BF,MLB)
       EQUIVALENCE        (TTO,CHNAME,LPSI,X1AF,MUB), (PTO,UP,LTT,S1F,PRIM)
       EQUIVALENCE        (TSO,LEDEX,LPT,NCHB,TYPELB)
       EQUIVALENCE        (PSO,ZBT,LRCU,NCHA,NAMELB)
      EQUIVALENCE        (MACHO,RBT,CRG,JORDER,ILB), (AO,ANGBT,CPGJ,VNR,FLB)
       EQUIVALENCE        (VARY,C2CP,S1LB), (RG,QGAM,TYPEUB)
       EQUIVALENCE        (GAM,FGT,NAMEUB), (NR,FGP,IUB), (NC,FGR,FUB)
       EQUIVALENCE         (TAB(1),AREATB,S1UB),(BB,ANGTE)
       EQUIVALENCE         (TAB(4),X2CL),(TAB(5),SLSWI),(TAB(6),MCL)
C
```

```
      COMMON /ALLCOM/ MACHA,PSA,TSA,PTA,TTA, AXIA,RGA,GAMA,
     1                MACHC,PSC,TSC,PTC,TTC, AXIC,RGC,GAMC,
     2                DAXIT,SCALEA,TTE,CHOTST
       REAL           MACHA,MACHC
       LOGICAL        AXIA,AXIC
      COMMON /CATAN3/ DANG
      COMMON /CB    / B(300)
      COMMON /CBEAM2/ DR,DZ,YPA,YPB,F,G, DX,YQDX,ZM,RM,ANGM,CURVM,S1M,
     1                RZONLY, ANGCHD,BINTVL, YPASQ,YPAB,YPBSQ
       LOGICAL        RZONLY
      COMMON /CBITS / BITS,BLANK
       INTEGER        BLANK
      COMMON /CIDEX / M,J,MU,MD,ISTAG
      COMMON /CM    / JMS(300)
      COMMON /CPI   / PI,TWOPI,PIO2,PIO4,TODEG,TORAD
      COMMON /CR    / R(300)
      COMMON /CRHS  / WSL(300)
      COMMON /CS2   / S2(300)
      COMMON /CTABPR/ I1TAB
      COMMON /CVM   / VM(300)
      COMMON /CZ    / Z(300)
      COMMON /ERASE / XX(1),YY,ANGG,NL,NT,CNL,CNU,BNL,BNU,NZERO
      COMMON /IXORIG/ LHO,LHE, LBDO,LBDE, LTO,LTE, LWO,LWE, LFO,LFE,
     *                LO,LESTA,LSO,LSE,LDUM(6),
     *                MO,NM, NJ,NFCOLS, MAXNJ,MAXOL,MAXNM,MAXLE,
     *                LEO,LEE, LRO,LRE,LRD

C     TABLE OF LEADING EDGE AND TRAILING EDGE POINTS
C      INDEX- LE=LEO,LEE,10
C      NLE,NTE=NO. OF L.E. AND T.E. COINCIDENT PTS. RESPECTIVELY
C      CHL,CHU=NAME OF CHANNEL ABOVE AND BELOW PT, RESPECTIVELY
C      BDL,BDU=BOUNDARY NAMES ASSOCIATED WITH THE POINTS
C      NUSED = COUNT OF TIMES THAT POINT USED IN CONSTRUCTION OF /ORTCHN/
       COMMON /LETEPT/ XE(1),YE(1),ANGE(1),NLE(1),NTE(1),
     1                 CHL(1),CHU(1),BDL(1),BDU(1),NUSED(491)
        INTEGER        CHL,CHU,BDL,BDU

C     TABLE OF CHANNELS EMBRACED BY EACH ORTHOGONAL
C      INDEX- LR=LRO,LRE,LRD
C      LRD    = NUMBER OF CHANNELS PLUS ONE,   LR INDEX INCREMENT
C      LEDGE  = INDEX OF THE ORTHOGONAL POINT IN THE LETEPT-TABLE
C      LRPREV= POINTER OF LINE OF UPSTREAM CHANNELS IN ORTCHN-TABLE
C      CHNA   = CHANNEL NAMES
       COMMON /ORTCHN/ LEDGE(1),LRPREV(1),CHNA(479)
        DIMENSION      JCHNA(1)
        EQUIVALENCE    (JCHNA,CHNA)
        INTEGER        CHNA

       COMMON /SPACER/ MAXLH,MAXLT,MAXLF,MAXLW
       COMMON /SLTAB / W(128),X2(128),SLCHN(128)
        INTEGER        SLCHN
       COMMON /TROUBL/ ERR,ERRMAJ,INERR,PRERR
        LOGICAL        ERR,ERRMAJ,INERR,PRERR

       INTEGER         CHNX,CHX,FIXCHN,HLE,HTE,SOLID
       LOGICAL         UPT

       DATA SOLID/5HSOLID/, HLE/2HLE/, HTE/2HTE/

C     USE INPUT SPACERS TO SET TABLE ORIGINS
       LTE    = LBDE
```

```
      LTO    = LTE+1
      LWE    = LTE+MAXLT
      LWO    = LWE+1
      LFE    = LWE+MAXLW
      LFO    = LFE+1
      LESTA  = LFE+MAXLF
      LO     = LESTA+1

C     ASSUMED INITIAL FIELD VELOCITY
      IF(MACHA.NE.BITS) TTA=TSA*(1.+.5*(GAMA-1.)*MACHA**2)
      VMINIT= .4*SQRT(RGA*TTA)

C**   BUILD ORTHOGONAL-CHANNEL TABLE

C*    BUILD ORDERED LIST OF CHANNELS FROM L.E. CONNECTIONS
C      SEARCH FOR THE FIRST LEADING EDGE PT (NLE=2 IN LETEPT-TABLE)
      LR3    = LRO
      LRE    = LR3-1
      LX     = 0
      DO 505 LE=LEO,LEE,10
  505 IF(NLE(LE).EQ.2) GO TO 510
C       NO L.E. PTS
      GO TO 535

C      LE=FIRST EDGE PT, FIND CONNECTING CHANNELS
  510 CHNA(LR3)=CHU(LE)
      CHNA(LR3+1)=CHL(LE)
      LRE    = LR3+1

C      SEARCH FOR CHANNELS BELOW CHNA(LR3)
  515 DO 517 LE3=LEO,LEE,10
      LEX    = LE3+LX
  517 IF(NLE(LEX).NE.0 .AND. CHL(LE3).EQ.CHNA(LR3)) GO TO 520
      WRITE (6,1560) CHNA(LR3)
      CALL ERROR1

C      CHECK FOR BOTTOM CHANNEL
  520 IF(CHU(LE3).EQ.BLANK) GO TO 525

C      MOVE CHU(LE3) BELOW CHNA(LR3)
      CALL MOVE(2, CHNA(LR3),CHNA(LR3+1),LR3-LRE-1,1,
     1                CHU(LE3),CHNA(LR3),1,1)
      LRE    = LRE+1
      GO TO 515

C      SEARCH FOR CHANNELS ABOVE CHNA(LRE)
  525 DO 530 LE4=LEO,LEE,10
      LEX    = LE4+LX
  530 IF(NLE(LEX).NE.0 .AND. CHU(LE4).EQ.CHNA(LRE)) GO TO 532
      WRITE (6,1560) CHNA(LRE)
      CALL ERROR1

C      CHECK FOR TOP CHANNEL
  532 IF(CHL(LE4).EQ.BLANK) GO TO 535

C      MOVE CHL(LE4) ABOVE CHNA(LRE)
      LRE    = LRE+1
      CHNA(LRE)=CHL(LE4)
      GO TO 525

C     REPEAT THE ABOVE FOR THE TRAILING EDGE
```

```
  535 IF(LX.EQ.1) GO TO 545
      LR1    = LR3
      LR2    = LRE
      LE1    = LE3
      LE2    = LE4
      LR3    = LR2+1
      LX     = 1
C     LX     = 1  TO PICK UP NTE(LE3) RATHER THAN NLE(LE3)

C     SEARCH FOR THE LAST T.E. PT
      LE     = LEE-9
  540 IF(NTE(LE).EQ.2) GO TO 510
      LE     = LE-10
      IF(LE.GE.LEO) GO TO 540

C    NO L.E. OR T.E. PTS
  545 IF(LRE-LR1) 547,555,555
  547 LE     = LEO
      IF(CHL(LE).NE.BLANK) GO TO 550
      IF(CHU(LE).NE.BLANK) GO TO 552
      CALL ERROR1
  550 CHNA(LR1)=CHL(LE)
      GO TO 554
  552 CHNA(LR1)=CHU(LE)
  554 LR2    = LR1
      LR3    = LR2+1
      CHNA(LR3)=CHNA(LR1)
      LRE    = LR3

C    CHECK FOR EXTRA CHANNELS IN LETEP-TABLE
  555 LE     = LEO
  556 IF(CHL(LE).EQ.BLANK) GO TO 558
      CHX    = CHL(LE)
      LX     = 0
      GO TO 560
  558 IF(CHU(LE).EQ.BLANK) GO TO 564
      CHX    = CHU(LE)
      LX     = 1
  560 DO 561 LR=LR1,LRE
  561 IF(CHNA(LR).EQ.CHX) GO TO 562
      ERR    = .TRUE.
      WRITE (6,1560) CHX
  562 IF(LX) 564,558,564
  564 LE     = LE+10
      IF(LE.LT.LEE) GO TO 556

C    LINE UP THE L.E. AND T.E. CONNECTED CHANNELS IN THE SAME COLUMN
C     LRL    = INDEX OF CHANNEL IN FIRST LINE (L.E. CONNECTED CHANNELS)
C     LRT    = INDEX OF CHANNEL IN SECOND LINE (T.E. CONNECTED CHANNELS)
      LRL    = LR1
      LRT    = LR3
      GO TO 588
  570 IF(LRE.LT.LRT) GO TO 578
      DO 575 LRX=LRT,LRE
  575 IF(CHNA(LRX).EQ.CHNA(LRL)) GO TO 580

C     LRL-CHANNEL NOT INCLUDED IN SECOND LINE, PUT IN BLANK SPACE.
      CALL MOVE(1, CHNA(LRT),CHNA(LRT+1),LRT-LRE-1,1)
  578 LRE    = LRE+1
      CHNA(LRT)=BLANK
      GO TO 586
```

```
C     LRX MATCHES LRL, PUT IN LRX-LRT BLANKS BEFORE LRL
  580 LDR    = LRX-LRT
      IF(LDR) 582,586,582
  582 LRTO   = LRL+LDR
      CALL MOVE(1, CHNA(LRL),CHNA(LRTO),LRL-LRE-1,1)
      LRE    = LRE+LDR
      LRT    = LRT+LDR
      LR2    = LR2+LDR
  584 CHNA(LRL)=BLANK
      LRL    = LRL+1
      LRT    = LRT+1
      IF(LRL.LT.LRTO) GO TO 584
C       IF NO CHANNELS ON FIRST LINE, SET FIRST VALUE TO THAT OF SECOND
      IF(LR2-LDR.LT.LR1) CHNA(LR1)=CHNA(LR2+1)

  586 LRL    = LRL+1
      LRT    = LRT+1
  588 IF(LRL.LE.LR2) GO TO 570
      IF(LRT.GT.LRE) GO TO 600
      LDR    = LRE-LRT+1
      GO TO 582

C     DEFINE ORTCHN-TABLE INCREMENT, LRD
  600 LRD    = LR2-LRO+3
      CALL MOVE(1, CHNA(LR2+1),CHNA(LR2+3),LR2-LRE,1)
      LRE    = LRE+4
      LEDGE(LRO)=BLANK
      LRPREV(LRO)=BLANK
      LRPRV = LRO
      LR     = LRO+LRD
      LEDGE(LR)=BLANK
      LRPREV(LR)=BLANK
      LR     = LR+LRD
      IF(ERR) CALL ERROR1

C*    BUILD STREAMLINE TABLE
      NJ     = 0
      LRL    = LRO
      LRT    = LRO+LRD
      X2SAV1= 0.
      X2SAV2= 0.
      DAREA = 0.
C       SEARCH FOR FIRST COMMON CHANNEL
  602 LRX1   = LRL
      LRX2   = LRL+LRD
      NBLNK1= 0
      NBLNK2= 0
  605 IF(CHNA(LRX1).EQ.CHNA(LRX2)) GO TO 610
      IF(CHNA(LRX1).NE.BLANK) NBLNK1=NBLNK1+1
      IF(CHNA(LRX2).NE.BLANK) NBLNK2=NBLNK2+1
      LRX1   = LRX1+1
      LRX2   = LRX2+1
      IF(LRX1.LE.LR2) GO TO 605

  610 DX2    = 8.*AMAX0(NBLNK1,NBLNK2)
      IF(DX2.EQ.0.) GO TO 620
      IF(NBLNK1.NE.0) DEL1=DX2/FLOAT(NBLNK1)
      IF(NBLNK2.NE.0) DEL2=DX2/FLOAT(NBLNK2)
  612 IF(CHNA(LRL).EQ.BLANK) GO TO 615
      CHX    = CHNA(LRL)
```

```
      X2(NJ+1)=X2SAV1
      X2SAV1= X2SAV1+DEL1
      X2(NJ+2)=X2SAV1
      GO TO 625
  615 CHX    = CHNA(LRT)
      X2(NJ+1)=X2SAV2
      X2SAV2= X2SAV2+DEL2
      X2(NJ+2)=X2SAV2
      GO TO 625
  620 CHX    = CHNA(LRL)
      X2(NJ+1)=X2(NJ)
      IF(NJ.EQ.0) X2(NJ+1)=0.
      X2(NJ+2)=X2(NJ+1)+8.
      X2SAV1=X2(NJ+2)
      X2SAV2=X2(NJ+2)
  625 SLCHN(NJ+1)=CHX
      SLCHN(NJ+2)=CHX
      W(NJ+1)=0.
         DO 630 LE1=LEO,LEE,10
  630    IF(NLE(LE1).NE.0 .AND. CHL(LE1).EQ.CHX) GO TO 632
  632    DO 635 LE2=LEO,LEE,10
  635    IF(NLE(LE2).NE.0 .AND. CHU(LE2).EQ.CHX) GO TO 637
  637    AREA   = YE(LE2)-YE(LE1)
         IF(AXIA) AREA=AREA*PI*(YE(LE2)+YE(LE1))
C        FOR INLET CONF. SAVE HIGHLIGHT AREA SO EXTERNAL AREA
C        MAY BE CORRECTED BY DIFF BET HIGHLIGHT AND CAPTURE AREAS.
         AREASV= AREA
         IF(CHNA(LRL).NE.BLANK) AREA=AREA+DAREA
         CALL BCONV(CHX,LT,AREA)
         IF(CHNA(LRL).NE.BLANK) DAREA=DAREA+AREASV-AREA
         LT     = LT+LPSI(LT)+NPT(LT)-1
      W(NJ+2)=XCH(LT)
      NJ     = NJ+2
      LRL    = LRL+1
      LRT    = LRT+1
      IF(LRL.GT.LR2) GO TO 639
      IF(LRL-LRX1) 612,620,602

C**   BEGIN LOOP FOR BUILDING CHANNEL LIST, STATION TABLE AND FIELD DATA
C       EACH ORTHOGONAL.
  639 LRPRV = LRO
      LRPRSV= 0
      M      = MO
      L      = LO
      LF     = LFO
      TTESQ  = TTE*TTE

C*    CONSIDER MARKED CHANNELS ON LINE LR=LRPRV IN /ORTCHN/
C     FIND INDEX OF FIRST AND LAST ACTIVE (NON-BLANK) CHANNEL
  640 LRP1  = LRPRV
      LRP2  = LRPRV+LRD-3
  642 IF(CHNA(LRP1).NE.BLANK) GO TO 644
      LRP1  = LRP1+1
      IF(LRP1.LE.LRP2) GO TO 642
      CALL ERROR1
  644 IF(CHNA(LRP2).NE.BLANK) GO TO 646
      LRP2  = LRP2-1
      GO TO 644

C     FIND INDEX-LE OF NEXT LE-TE PT IN LRPRV-CHANNELS
  646 LE     = LEO
```

```
  648 IF(NUSED(LE)-NLE(LE)-NTE(LE)) 650,654,654
  650 LEONCE= NUSED(LE)
      IF(NTE(LE).NE.0) LEONCE=0
      LRP    = LRP1
  652 IF(CHNA(LRP).EQ.BLANK) GO TO 653
      IF(CHNA(LRP).EQ.CHU(LE) .AND. LEONCE.LE.0) GO TO 660
      IF(CHNA(LRP).EQ.CHL(LE)) GO TO 665
  653 LRP    = LRP+1
      IF(LRP.LE.LRP2) GO TO 652
  654 LE     = LE+10
      IF(LE.LE.LEE) GO TO 648
C       NO MORE POINTS
        CALL ERROR1

C       LE IS UPPER BOUNDARY POINT (LOWER ORTHOGONAL)
  660 LRP2   = LRP
      UPT    = .TRUE.
      GO TO 670

C       LE IS LOWER BOUNDARY POINT (UPPER ORTHOGONAL)
  665 LRP1   = LRP
      UPT    = .FALSE.

C     MARK CHANNEL NAMES OF THE NEW ORTHOGONAL ON LINE LR
  670 CALL SETM(1,BLANK, LEDGE(LR),LRD)
      LR1    = LR + LRP1-LRPRV
      LR2    = LR + LRP2-LRPRV
      CALL MOVE(1, CHNA(LRP1),CHNA(LR1),LR2-LR1+1,1)
      LRE    = LR+LRD-1

C     UPDATE USED LETEPT COUNT AND SET POINTERS FOR LINE-LR
  672 NUSED(LE)=NUSED(LE)+1
      LRPREV(LR)=LRPRV
      LEDGE(LR)=LE
      NLETE  = NLE(LE)+NTE(LE)
      IF(NLETE-NUSED(LE).EQ.0) LEDGE(LR)=-LEDGE(LR)

C     COUNT NUMBER OF CHANNELS, SET FIELD TABLE LIMITS
      NCHNA  = 0
      DO 675 LRX=LR1,LR2
  675 IF(CHNA(LRX).NE.BLANK) NCHNA=NCHNA+1
      M1     = M
      MLB(L)= M1
      M2     = M1+NCHNA+NCHNA-1
      MUB(L)= M2

      NM     = M2
      LESTA  = L+20

C     IF UPSTREAM OR DOWNSTREAM BOUNDARY, SEARCH FOR OTHER EDGE
      IF(NLE(LE).EQ.1) GO TO 679
      IF(NTE(LE).EQ.1) GO TO 681
      GO TO 720
  679 LX     = 0
      GO TO 682
  681 LX     = 1
  682 IF(.NOT.UPT) GO TO 690

C     FIND LOWER EDGE PT
  684 DO 686 LE1=LEO,LEE,10
      LEX    = LE1+LX
```

```
  686 IF(NLE(LEX).EQ.1 .AND. CHL(LE1).EQ.CHNA(LR1)) GO TO 688
      CALL ERROR1
  688 LE2    = LE
      NUSED(LE1)=NUSED(LE1)+1
      GO TO 700

C       FIND UPPER EDGE PT
  690 DO 692 LE2=LE0,LEE,10
      LEX    = LE2+LX
  692 IF(NLE(LEX).EQ.1 .AND. CHU(LE2).EQ.CHNA(LR2)) GO TO 694
      CALL ERROR1
  694 LE1    = LE
      NUSED(LE2)=NUSED(LE2)+1

C*    PLACE UPSTREAM OR DOWNSTREAM BOUNDARY DATA INTO STATION TABLE
  700 NAMELB(L)=BDL(LE1)
      NAMEUB(L)=BDU(LE2)
      IF(NTE(LE).EQ.1) GO TO 710
C       UPSTREAM BOUNDARY
      ILB(L)= 1
      FLB(L)= 0.
      S1LB(L)=0.
      LB     = LBF(NAMEUB(L))
      IUB(L)= (LBNEXT(LB)-9-LBZ1(LB))/3
      FUB(L)= 1.
      CALL BARC(LB+LBNEXT(LB)-12)
      S1UB(L)=SINTVL
      GO TO 715
C       DOWNSTREAM BOUNDARY
  710 LB     = LBF(NAMELB(L))
      ILB(L)= (LBNEXT(LB)-9-LBZ1(LB))/3
      FLB(L)= 1.
      CALL BARC(LB+LBNEXT(LB)-12)
      S1LB(L)=SINTVL
      IUB(L)= 1
      FUB(L)= 0.
      S1UB(L)=0.
  715 Z(M1) = XE(LE1)
      R(M1) = YE(LE1)
      Z(M2) = XE(LE2)
      R(M2) = YE(LE2)
      GO TO 800

C     FIND LE OR TE ORTHOGONAL LOWER BOUNDARY INTERSECTION
C       PLACE DATA IN STATION TABLE
C        USE LETEPT-TABLE TO DETERMINE NAME OF UPPER BOUNDARY
  720 IF(NLETE.EQ.2 .OR. NLETE.EQ.0) GO TO 722
      CALL ERROR1
  722 IF(.NOT.UPT) GO TO 740
      DO 725 LE1=LE0,LEE,10
      IF(CHL(LE1).EQ.CHNA(LR1)) GO TO 726
  725 CONTINUE
  726 NAMELB(L)=BDL(LE1)
      NAMEUB(L)=BDU(LE)
      CALL OBI(XE(LE),YE(LE),ANGE(LE),BDL(LE1),CHL(LE1),
     1          ILB(L),FLB(L),S1LB(L), Z(M1),R(M1))
C       SEEK POINTER TO BOUNDARY TABLE
      LB     = LBF(NAMEUB(L))
      IRET   = 1
      IF(NTE(LE).NE.2) GO TO 728
C        TRAILING EDGE
```

```
      IV     = 1
      LB     = LB+LBZ1(LB)
      GO TO 733
C      LEADING EDGE OR CORNER
  728 LB1    = LB+LBZ1(LB)
      LB2    = LB+LBNEXT(LB)-9
      IV     = 1
      DO 730 LB=LB1,LB2,3
      IF(ZBT(LB).EQ.XE(LE) .AND. RBT(LB).EQ.YE(LE)) GO TO 732
  730 IV     = IV+1
      CALL ERROR1
C      TEMPORARILY STORE SHARP CORNER INDICATION IN MCL(L) (I.E. ANGLE
C      JUMP OF MORE THAN 0.5 DEG.)
  732 MCL(L)= 2
      IF(NLETE.EQ.0 .AND. ABS(ANGBT(LB)-ANGBT(LB+3)).GT..0087) MCL(L)=1
      IF(IRET) 733,753,733
  733 IUB(L)= IV
      FUB(L)= 0.
      S1UB(L)=0.
      Z(M2) = ZBT(LB)
      R(M2) = RBT(LB)
      GO TO 800

C    FIND LE OR TE ORTHOGONAL UPPER BOUNDARY INTERSECTION
C     PLACE DATA IN STATION TABLE
  740 DO 745 LE2=LE0,LEE,10
      IF(CHU(LE2).EQ.CHNA(LR2)) GO TO 747
  745 CONTINUE
  747 NAMELB(L)=BDU(LE)
      NAMEUB(L)=BDU(LE2)
      CALL OBI(XE(LE),YE(LE),ANGE(LE),BDU(LE2),CHU(LE2),
     1          IUB(L),FUB(L),S1UB(L), Z(M2),R(M2))
C     SEEK POINTER TO BOUNDARY TABLE
      LB     = LBF(NAMELB(L))
      IRET   = 0
      IF(NTE(LE).NE.2) GO TO 728
C      TRAILING EDGE
      LB2    = LB+LBNEXT(LB)-9
      ILB(L)= (LB2-(LB+LBZ1(LB)))/3
      FLB(L)= 1.
      CALL BARC(LB2-3)
      S1LB(L)=SINTVL
      LB     = LB2
      GO TO 757
C      LEADING EDGE OR CORNER
  753 ILB(L)= IV
      FLB(L)= 0.
      S1LB(L)=0.
  757 Z(M1) = ZBT(LB)
      R(M1) = RBT(LB)

C*   ADD NEW FIELD POINTS ALONG EXISTING STREAMLINES
C    GIVEN-
C     STA-TAB INDEX L AND LIMITS ON FIELD INDEX MLB,MUB
C     COORDINATES OF FIRST AND LAST NEW PTS IN FIELD TABLE
C     MARKED CHANNELS IN ORTCHN TABLE BETWEEN LR1,LR2
C     STREAMLINE TABLE
  800 MSAV   = M0
C     MSAV   = 0 INDICATES UPSTREAM BOUNDARY
      IF(NLE(LE).EQ.1) MSAV=0
      J1     = 1
```

```
      CALL JOFCHN(CHNA(LR1),J1,JX)
      CALL JOFCHN(CHNA(LR2),JX,J2)
C     J1,J2 ARE SL INDEX LIMITS

C     BEGIN LOOP THROUGH CHANNELS, 2 SLS PER CHANNEL
      LRN    = LR1
      MM     = M1
      JSL    = J1
  805 IF(CHNA(LRN).EQ.BLANK) GO TO 835
      CALL JOFCHN(CHNA(LRN),JSL,JNXT)

C     FIND UPSTREAM FIELD PT, PUT IN DOWNSTREAM POINTER
  810 J      = JSL
      IF(MSAV) 812,828,812
  812 IV     = 0
  815 DO 820 M=MSAV,NM
      CALL GETIX
  820 IF(J.EQ.JSL .AND. MD.EQ.0) GO TO 825
      IF(IV.NE.0) CALL ERROR1
      MSAV   = MO
      IV     = 1
      GO TO 815
  825 MSAV   = M
      MD     = MM
      CALL SAVIX

C     SAVE DATA FOR CURRENT FIELD PT
  828 M      = MM
      MU     = MSAV
      MD     = 0
      ISTAG  = 0
      CALL SAVIX

C     ADD CHANNEL FLOWS FOR LATER INTERPOLATION OF SL POSITION
C     IF NOT AN UPSTREAM BOUNDARY, USE UPSTREAM AREAS IN PLACE OF FLOW,
C     *USE  CURV  FOR STORAGE
      WSL(M)= 0.
      IF(M.EQ.M1) GO TO 830
      WSL(M)= WSL(M-1)+W(J)
      IF(MSAV.EQ.0) GO TO 830
      AREA  = SQRT((R(MU)-R(MUM1))*(R(MU)*R(MUM1)) +
     1             (Z(MU)-Z(MUM1))*(Z(MU)-Z(MUM1)))
      IF(AXIA) AREA=(R(MU)+R(MUM1))*AREA
      WSL(M)= WSL(M-1)+AREA

  830 MM     = MM+1
      MUM1   = MU
      IF(JSL.EQ.JNXT) GO TO 835
      JSL    = JNXT
      GO TO 810

C     INCREMENT TO NEXT CHANNEL
  835 LRN    = LRN+1
      IF(LRN.LE.LR2) GO TO 805

C     INTERPOLATE FOR COORDINATES
         IF(.NOT.AXIA .OR. R(M1).GE.0.) GO TO 836
         WRITE (6,1835)
         CALL ERROR1
  836 DZ21   = Z(M2)-Z(M1)
      DR21   = R(M2)-R(M1)
```

```
      DRSQ21= DR21*(R(M2)+R(M1))
      RM1SQ = R(M1)*R(M1)
      S2(M1)= 0.
      S2(M2)= SQRT(DZ21*DZ21+DR21*DR21)
C        CHECK FOR POSITIVE OL LENGTH
         ANGREF= ANGE(LE)
         ANGOL = ATAN3(DR21,DZ21,ANGREF)
         IF(DANG.GE.0. .AND. DANG.LT.PI) GO TO 837
         WRITE(6,1837) Z(M1),R(M1),Z(M2),R(M2),LE,LR,ANGREF
         CALL ERROR1
  837 VM(M1)= VMINIT
      VM(M2)= VMINIT
      MP     = M1+1
      MM     = M2-1
      IF(MM.LT.MP) GO TO 840
      DO 838 M=MP,MM
      VM(M) = VMINIT
      F       = (WSL(M)-WSL(M1))/(WSL(M2)-WSL(M1))
      Z(M)    = Z(M1)+F*DZ21
      R(M)    = R(M1)+F*DR21
      S2(M) = F*S2(M2)
      IF(.NOT.AXIA) GO TO 838
      R(M)    = SQRT(RM1SQ+F*DRSQ21)
      S2(M) = SQRT((R(M)-R(M1))*(R(M)-R(M1))+(F*DZ21)*(F*DZ21))
  838 CONTINUE

C     FINISH OUT STATION TABLE
C     CHECK FOR L.E., T.E, OR SHARP CORNER
C      LE     = INDEX OF PT IN LETEPT-TABLE
C     NLETE = 0 IS A SHARP CORNER
  840 X1(L) = 8.*FLOAT((LE+1-LEO)/10)
      LNEXT(L)=20
      TYPELB(L)=SOLID
      TYPEUB(L)=SOLID
      X2CL(L)=BITS
      IF(NLETE.EQ.1) GO TO 848
      IF(UPT) GO TO 842
C      UPT=F
      X2CL(L)=X2(J1)
      M       = MLB(L)
      GO TO 843
C      UPT=T
  842 X2CL(L)=X2(J2)
      M       = MUB(L)
  843 CALL GETIX
      IF(NLE(LE).NE.2) GO TO 845
      ISTAG = 1
      LNEXT(L)=22
      IF(UPT) GO TO 844
      TYPELB(L)=HLE
      GO TO 845
  844 TYPEUB(L)=HLE
  845 IF(NTE(LE).NE.2) GO TO 847
      ISTAG = 2
      LNEXT(L)=27
      BSQEXP(L)=BITS
      IF(UPT) GO TO 846
      TYPELB(L)=HTE
      GO TO 847
  846 TYPEUB(L)=HTE
  847 IF(NLETE.EQ.0) ISTAG=MCL(L)
```

```
      CALL SAVIX
  848 VMB(L)= VMINIT
      DWDV(L)=0.
      SLSWI(L)=0.
      PRIM(L)=1
      M      = MUB(L)+1
      LSAVE  = L
      L      = L+LNEXT(L)
      LESTA  = L-1

C*    INDEX TO NEXT ORTHOGONAL
C     LOOK FOR ORTHOGONALS TO BE PLACED ABOVE L.E. POINTS
C      IF THIS IS A DOWNSTREAM BOUNDARY OR LOWER T.E. ORTHOG
  850 IF(NTE(LE).EQ.0) GO TO 920
      IF(NTE(LE).EQ.1) GO TO 855
C      NTE(LE)=2
      IF(NUSED(LE).EQ.2) GO TO 900
  855 LRX    = LR
  860 LRX    = LRPREV(LRX)
C     LRPREV= BLANK FOR UPSTREAM OR DUMMY ORTCHN-LISTS
      IF(LRPREV(LRX).EQ.BLANK) GO TO 862
      IF(LEDGE(LRX).LE.0) GO TO 860
      LRPRV  = LRPREV(LRX)
      GO TO 864
  862 LRPRV  = LRPRSV
      LRPRSV= 0

C     IS THE CHANNEL ON THE OTHER SIDE OF THE T.E. IN THE LRPRV-LIST
  864 IF(NTE(LE).NE.2) GO TO 915
      CHNX   = CHU(LE)
      IF(UPT) CHNX=CHL(LE)
      IF(LRPRV.EQ.0) GO TO 870
      LRX2   = LRPRV+LRD-3
      DO 866 LRX=LRPRV,LRX2
  866 IF(CHNA(LRX).EQ.CHNX) GO TO 925
C      DID NOT FIND CHNX. SAVE LRPRV
      IF(LRPRSV.NE.0) CALL ERROR1
      LRPRSV= LRPRV

C     FIND UPSTREAM BOUNDARY WHICH INCLUDES CHANNEL CHNX
  870 LR     = LR+LRD
      CALL SETM(1,BLANK, LEDGE(LR),LRD)
      LRE    = LR+LRD-1
      LRPRV  = LRO+LRD
      LRP1   = LRPRV
      LRP2   = LRP1+LRD-3
      DO 872 LRP=LRP1,LRP2
  872 IF(CHNA(LRP).EQ.CHNX) GO TO 873
      CALL ERROR1
  873 LR1    = LR+LRP-LRP1
      CHNA(LR1)=CHNX
      LR2    = LR1
      LRP1   = LRP
      LRP2   = LRP

C     SEARCH FOR CHANNELS BELOW CHNA(LR1)
  875 DO 876 LE1=LEO,LEE,10
  876 IF(NLE(LE1).NE.0 .AND. CHL(LE1).EQ.CHNA(LR1))GO TO 878
      GO TO 896
C      CHECK FOR BOTTOM CHANNEL
  878 IF(CHU(LE1).EQ.BLANK) GO TO 884
```

```
C       USE CHU(LE1) AS PART OF THE UPSTREAM BOUNDARY
  880 LRP1   = LRP1-1
      LR1    = LR1-1
      IF(CHU(LE1).EQ.CHNA(LRP1)) GO TO 882
      IF(LR1.GT.LR) GO TO 880
      GO TO 896
  882 CHNA(LR1)=CHU(LE1)
      GO TO 875

C     SEARCH FOR CHANNEL ABOVE LR2
  884 DO 888 LE2=LE0,LEE,10
  888 IF(NLE(LE2).NE.0 .AND. CHU(LE2).EQ.CHNA(LR2)) GO TO 892
      GO TO 896
C       CHECK FOR TOP CHANNEL
  892 IF(CHL(LE2).EQ.BLANK) GO TO 899
C       USE CHL(LE2) AS PART OF THE UPSTREAM BOUNDARY
  894 LRP2   = LRP2+1
      LR2    = LR2+1
      IF(CHL(LE2).EQ.CHNA(LRP2)) GO TO 898
      IF(LR2.LT.LRE) GO TO 894
  896 CALL ERROR1
C     REFER ALSO TO EFN 876, 882,888, FOR THE ERROR
  898 CHNA(LR2)=CHU(LE2)
      GO TO 884

  899 LE     = LE1
      UPT    = .FALSE.
      GO TO 672

C    TRAILING EDGE PT WITH ORTHOGONALS ON BOTH SIDES, BUILD DUMMY
C     LRPRV-LIST TO REPRESENT COALESCING OF UPPER AND LOWER STREAMS.
C       LOOK BACK FOR ORTHOG ON OTHER SIDE OF T.E.
  900 DO 904 LRP=LR0,LRE,LRD
  904 IF(LEDGE(LRP).EQ.LE) GO TO 908
  908 LEDGE(LRP)=-LEDGE(LRP)
      LRX1   = LRP
      LRX2   = LR
      LR     = LR+LRD
      LRX    = LR
      LRE    = LR+LRD-3
      CALL SETM(1,BLANK,LEDGE(LR),LRD)
      LEDGE(LR)=0
      LRPREV(LR)=LRX2
  910 IF(CHNA(LRX1).NE.BLANK) CHNA(LRX)=CHNA(LRX1)
      IF(CHNA(LRX2).NE.BLANK) CHNA(LRX)=CHNA(LRX2)
      LRX1   = LRX1+1
      LRX2   = LRX2+1
      LRX    = LRX+1
      IF(LRX.LE.LRE) GO TO 910
      LRE    = LRE+2

C     BUILD FLOW ADJUSTMENT TABLE. /CADJWF/
      LM1    = LSAVE
      X1F(LF)=X1(LM1)
      X2F(LF)=X2CL(LM1)
      S1F(LF)=ANGE(LE)
      LM2    = L0
  911 IF(LM2.GE.LESTA) GO TO 912
      IF(X1(LM2).EQ.X1(LM1)) GO TO 912
      LM2    = LM2+LNEXT(LM2)
      GO TO 911
```

```
  912 IF(UPT) GO TO 913
      LFB(LF)=LM2
      LFA(LF)=LM1
      LRXF(LF)=LR1-1+LRD
      GO TO 914
  913 LFB(LF)=LM1
      LFA(LF)=LM2
      LRXF(LF)=LR2+LRD
  914 LRF(LF)=LR
      VNR(LF)= 0.
      LF     = LF+NFCOLS
      LFE    = LF-1
      GO TO 920

C     DOWNSTREAM BOUNDARY, ARE ALL L.E. ORTHOGONAL COMPLETED
  915 IF(LRPRV.NE.0) GO TO 925
      IF(LRPRSV.EQ.0) GO TO 930
      LRPRV = LRPRSV
      GO TO 925

  920 LRPRV = LR
  925 LR     = LR+LRD
      GO TO 640

C*** RELOCATE CONTROL STREAMLINE, X2CL, TO THE FIRST PRIMARY OF REGION
  930 L      = LO
  935 LP1    = L+LNEXT(L)
      IF((LP1).GE.LESTA) GO TO 960
      IF(X1(LP1).LE.X1(L)) GO TO 940
      IF(X2CL(LP1).EQ.BITS) GO TO 950
      X2CL(L)=X2CL(LP1)
      GO TO 950
  940 X2CL(L)=BITS
  950 L      = LP1
      GO TO 935

  960 L      = LO
      IF(X2CL(L).NE.BITS) GO TO 980
      M      = MLB(L)
      CALL GETIX
      X2CL(L)=X2(J)

C     BUILD WAKE DISPLACEMENT THICKNESS TABLE, /WAKETB/
  980 IF(LFE.LE.LFO) GO TO 1139
      LF     = LFO
  990 LBX    = LFB(LF)
      LAX    = LFA(LF)
      M1     = MUB(LBX)
      M      = MLB(LAX)
      DZ21   = Z(M)-Z(M1)
      DR21   = R(M)-R(M1)
      THK    = DZ21*DZ21+DR21*DR21
      DANG   = ATANB(DR21,DZ21,S1F(LF))-PIQ2-S1F(LF)
C      THE MEAN T.E. ANGLE WAS TEMPORARILY STORED IN S1F
      THK    = COS(DANG)*SQRT(THK)
      IF(AXIA) THK=THK*PI*(R(M)+R(M1))
  995 CALL GETIX
      CALL BWAKE(J,THK)
      LF     = LF+NFCOLS
      IF(LF.LT.LFE) GO TO 990
```

```
C     LOOP THROUGH FLOW ADJUSTMENT TABLE OF T.E. STATIONS
C      DETERMINE IF FLOW IS TO BE ADJUSTED BELOW T.E. (JORDER=0), ABOVE
C      T.E. (JORDER=1), IF TOTAL FLOW ABOVE+BELOW IS TO REMAIN CONSTANT
C      (JORDER=0), OR BOTH FLOWS ARE FIXED (JORDER=3).
       LF     = LFO
 1040  JORDER(LF)=0
       L      = LFB(LF)

C      LOOP TO FIND ALL CHANNELS BELOW (ABOVE) T.E.
 1045  M      = MLB(L)
       FIXCHN= 0
 1050  CALL GETIX

C      FIND INDEX LH IN CHANNEL TABLE
       LH     = LHO
 1060  IF(LH.GE.LHE) GO TO 1070
       IF(CHNAM(LH).EQ.SLCHN(J)) GO TO 1065
       LH     = LH+LHNEXT(LH)
       GO TO 1060
 1065  IF(.NOT.VARY(LH)) GO TO 1070

C      INDEX TO NEXT CHANNEL
       M      = M+2
       IF(M.LT.MUB(L)) GO TO 1050
       GO TO 1080

C      FIXED CHANNEL
 1070  FIXCHN= SLCHN(J)

C      BELOW T.E.
 1080  IF(L.NE.LFB(LF)) GO TO 1090
       IF(FIXCHN.NE.0) JORDER(LF)=1
       L      = LFA(LF)
       GO TO 1045

C      ABOVE T.E.
 1090  IF(FIXCHN.NE.0) JORDER(LF)=JORDER(LF)+2
       X1BF(LF)=X1F(LF)
       X1AF(LF)=X1F(LF)
       LF     = LF+NFCOLS
       IF(LF.LE.LFE) GO TO 1040


C     ELIMINATE GAPS BETWEEN EQUIVALENCED TABLES
 1139  NMOVE = LWE-LWO+1
       CALL MOVE(1, X2W(LWO),X2W(LTE+1),NMOVE,1)
       LWO    = LTE+1
       LWE    = LTE+NMOVE

       NMOVE = LFE-LFO+1
       CALL MOVE(1, X1F(LFO),X1F(LWE+1),NMOVE,1)
       LFO    = LWE+1
       LFE    = LWE+NMOVE

       NMOVE = LESTA-LO+1
       CALL MOVE(1, X1(LO),X1(LFE+1),NMOVE,1)
       LO     = LFE+1
       LESTA = LFE+NMOVE

C      INITIALIZE  B
       CALL SETM(1,1./1024., B,NM)
```

```
      RETURN
1560 FORMAT(1X47HERROR, CONNECTING EDGES WERE NOT FOUND FOR CHN=A6,22H
    *   (SUBROUTINE BLDTBS))
1835 FORMAT(/1X47H***  ERROR* NEGATIVE RADIUS ENCOUNTERED. AXI=T.,
    *          10H  (BLDTBS))
1837 FORMAT (20H ***  THE FIRST PT (,2F9.3,15H) AND LAST PT (,2F9.3,
    1 26H) FOR THIS ORTHOGONAL (LE=,I5,4H LR=,I5,1H)/ 6X,51HARE NOT IN
    &THE CORRECT ORDER FOR THE FLOW DIRECTION,F8.4,8HRADIANS./
    36X,64HPROBABLE CAUSE IS INCORRECT NAMING OR DESIGNATION OF BOUNDAR
    4IES.)
      END
```

```
*DECK BWAKE
      SUBROUTINE BWAKE(JX,THK)
*BWAKE*          BUILD WAKE TABLE                                       *BWAKE*

C     INPUT-
C      JX     = WAKE STREAMLINE
C      THK    = T.E. THICKNESS

C     TABLE OF WAKE DISPLACEMENT THICKNESS
C      INDEX- LW=LWO,LWE
      COMMON /CHDATA/          X2W(1),LWNEXT(1),S1W(47)
       DIMENSION         DST(1)
       EQUIVALENCE       (DST,S1W)
C     SUBTABLE ARRANGEMENT IS-
C      X2W,LWNEXT(=2+2N), S1W(1),S1W(2)...S1W(N), DST(1),DST(2)...DST(N)
C     X2W     = STREAMLINE COORDINATE
C     S1W     = DISTANCE ALONG STREAMLINE FROM T.E.
C     DST     = WAKE DISPLACEMENT THICKNESS AS A FUNCTION OF S1W
C
      COMMON /IXORIG/ LHO,LHE, LBDO,LBDE, LTO,LTE, LWO,LWE, LFO,LFE,
     *                LO,LESTA,  LDUM(8),
     *                MO,NM, NJ,NFCOLS, MAXNJ,MAXOL,MAXNM,MAXLE,
     *                LEO,LEE, LRO,LRE,LRD
       DIMENSION      LIMITS(24)
       EQUIVALENCE    (LIMITS,LHO)
      COMMON /SLTAB / W(128),X2(128),SLCHN(128)
       INTEGER SLCHN

      IF(LWE.GT.LWO) GO TO 110
      LW     = LWO
  110 X2W(LW)=X2(JX)
      S1W(LW)=0.
      S1W(LW+1)=10.*ABS(THK)
      S1W(LW+2)=S1W(LW+1)
      S1W(LW+3)=S1W(LW+2)+S1W(LW+2)
      DST(LW+4)=THK
      DST(LW+5)=0.
      DST(LW+6)=0.
      DST(LW+7)=0.
      N      = 4
      LWNEXT(LW)=2+N+N
      LW     = LW+LWNEXT(LW)
      LWE    = LW-1
      IF (THK.LT.0.) WRITE (6,1200) THK,X2(JX)
 1200 FORMAT(41H *** ERROR - NEGATIVE T.E. THICKNESS OF ,F11.5,
     1       8H AT X2=,F7.3,1H.)
      RETURN
      END
```

```
*DECK FILL
      SUBROUTINE FILL(X,Y,NA,NB)
CFILL
C    LINEAR INTERPOLATION TO FIL VACANCIES IN INPUT LISTS
      COMMON /CBITS/BITS
      DIMENSION X(10),Y(10)
C    FIND IA,IB - VACANT REGION
      IA=NA+1
      IF(Y(IA-1).EQ.BITS) GO TO 99
    3 DO 4 I=IA,NB
      IF(Y(I).NE.BITS) GO TO 5
    4 CONTINUE
      IB=NB
      GO TO 7
    5 IB=I-1
      IF(I.EQ.IA) GO TO 12
C    FILL VACANCIES
      IF(Y(IB+1).NE.Y(IA-1)) GO TO 9
C     ALL VALUES THE SAME
    7 DO 8 II=IA,IB
    8 Y(II)=Y(IA-1)
      GO TO 12
C     INTERPOLATE
    9 DX = X(IB+1) - X(IA-1)
      DO 11 II=IA,IB
   11 Y(II) = (Y(IB+1)*(X(II)-X(IA-1)) + Y(IA-1)*(X(IB+1)-X(II)))/DX
C    GO BACK AND SEARCH FOR MORE REGIONS
   12 IA = IB+2
      IF(I.LT.NB) GO TO 3
   99 RETURN
      END
```

```
*DECK JOFCHN
      SUBROUTINE JOFCHN(CHN,JA,JB)
*JOFCHN          STREAMLINE INDEX FROM CHANNEL NAME             *JOFCHN*

C     INPUT-
C      CHN    = NAME OF CHANNEL
C      JA     = STREAMLINE FOR WHICH SEARCH WILL BE INITIATED

C     OUTPUT-
C      JA,JB = FIRST AND LAST INDEX OF STREAMLINES BELONGING TO CHN

       INTEGER CHN
      COMMON /IXORIG/ LHO,LHE, LBDO,LBDE, LTO,LTE, LWO,LWE, LFO,LFE,
     *                LO,LESTA,  LDUM(8),
     *                MO,NM, NJ,NFCOLS, MAXNJ,MAXOL,MAXNM,MAXLE,
     *                LEO,LEE, LRO,LRE,LRD
       DIMENSION      LIMITS(24)
       EQUIVALENCE    (LIMITS,LHO)
      COMMON /SLTAB / W(128),X2(128),SLCHN(128)
       INTEGER SLCHN

      LOGICAL          SECOND

      SECOND= .FALSE.
      J      = JA
   55 IF(CHN.NE.SLCHN(J)) GO TO 65
      IF(SECOND) GO TO 60
      SECOND= .TRUE.
      JA     = J
   60 JB     = J
      GO TO 70
   65 IF(SECOND) RETURN
   70 J      = J+1
      IF(J.LE.NJ) GO TO 55
      IF(.NOT.SECOND) CALL ERROR1
      RETURN
      END
```

```
*DECK OBI
      SUBROUTINE OBI(XPT,YPT,APT,NAMBDY,NAMCHN, I,FA,S1,XB,YB)
*OBI--=          ORTHOGONAL-BOUNDARY INTERSECTION               @OBI@

C     INPUT-
C      XPT    = X-COOR OF PT ON THE ORTHOGONAL
C      YPT    = Y-COOR OF PT ON THE ORTHOGONAL
C      APT    = ANGLE OF SL PERPENDICULAR TO ORTHOGONAL
C      NAMBDY= BOUNDARY NAME
C      NAMCHN= NAME OF CHANNEL ADJACENT TO  NAMBDY

C     OUTPUT-
C      I      = INTERVAL OF ORTHOGONAL-BOUNDARY INTERSECTION
C      FA     = FRACTIONAL POSITION IN THE INTERVAL
C      S1     = ARC DISTANCE FROM BEGINNING OF THE INTERVAL
C      XB,YB = COORDINATES OF THE INTERSECTION

C     BOUNDARY TABLE
C      INDEX- LB=LBDO,LBDE
C      LBNEXT= INCREMENT TO NEXT BOUNDARY
C      LBZ1   = INCREMENT TO THE FIRST BOUNDARY POINT (=0 BEFORE COALLATIO
C      CHNAME= CHANNEL WITH WHICH THE BOUNDARY DATA IS ASSOCIATED
C      UP     = T OR F FOR UPPER OR LOWER BOUNDARY
C      LEDEX = RELATIVE INDEX OF L.E. POINT WHEN LOWER AND UPPER SURFACE
C              CONTOURS ARE CONNECTED
C      BDNAME,LBA,LBB=NAME AND INDEX LIMITS OF SPECIFIC BOUNDARY
C                    DATA WHEN BOUNDARIES ARE COALLATED
      COMMON /CHDATA/ BDT(1),LBNEXT(1),LBZ1(1),
     1                CHNAME(1),UP(1),LEDEX(1),
     2                ZBT(1),RBT(1),ANGBT(42)
       LOGICAL        UP
       INTEGER BDT,CHNAME,BDNAME
       DIMENSION      BDNAME(1),LBA(1),LBB(1)
       EQUIVALENCE    (BDNAME,ZBT), (LBA,RBT), (LBB,ANGBT)
C
      COMMON /CBEAM2/ DR,DZ,YPA,YPB,F,G, DX,YODX,ZM,RM,ANGM,CURVM,S1M,
     1                RZONLY, ANGCHD,SINTVL, YPASQ,YPAB,YPBSQ
       LOGICAL        RZONLY
      COMMON /IXORIG/ LHO,LHE, LBDO,LBDE, LTO,LTE, LWO,LWE, LFO,LFE,
     *                LO,LESTA,  LDUM(8),
     *                MO,NM, NJ,NFCOLS, MAXNJ,MAXOL,MAXNM,MAXLE,
     *                LEO,LEE, LRO,LRE,LRD
       DIMENSION      LIMITS(24)
       EQUIVALENCE    (LIMITS,LHO)

      COMMON /CPI   / PI,TWOPI,PIO2,PIO4,TODEG,TORAD
      COMMON /TROUBL/ ERR,ERRMAJ,INERR,PRERR
       LOGICAL        ERR,ERRMAJ,INERR,PRERR

      LOGICAL         FGE1

C     DETERMINE INTERVAL INDEX LIMITS, LB1,LB2, OF @NAMBDY@
      LB    = LBF(NAMBDY)
      LB10  = LB+LBZ1(LB)
      LB20  = LB+LBNEXT(LB)-12
      LB1   = LB10
      LB2   = LB20
      IF(LEDEX(LB).NE.0) GO TO 105
C     BDMSLA= BOUNDARY MINUS STREAMLINE ANGLE
      BDMSLA= 0.
      IF(UP(LB)) BDMSLA=PI
      GO TO 120
```

```
  105 LB2    = LB+LEDEX(LB)-3
      BDMSLA= PI
      IF(CHNAME(LB).EQ.NAMCHN) GO TO 120
      LB1    = LB2+3
      LB2    = LB20
      BDMSLA= 0.
      IF(CHNAME(LB+1).EQ.NAMCHN) GO TO 120
      CALL ERROR1

  120 FGE1   = .FALSE.
      DO 150 LB=LB1,LB2,3
      DZ     = ZBT(LB+3)-ZBT(LB)
      DR     = RBT(LB+3)-RBT(LB)
      SB     = SQRT(DZ*DZ+DR*DR)
      IF(SB.EQ.0.) GO TO 150
      CSB    = DZ/SB
      SNB    = DR/SB
C     AP     = ANGLE OF THE PERPENDICULAR OR ORTHOGONAL
      AP     = .50*APT + .50*(ATAN3(DR,DZ,APT+BDMSLA)-BDMSLA) + PIO2
      SNP    = SIN(AP)
      CSP    = COS(AP)
C     D      = SIN(AB-AP)
      D      = SNB*CSP-CSB*SNP
      IF(ABS(D).LT..01) GO TO 150
      XP     = XPT-ZBT(LB)
      YP     = YPT-RBT(LB)
      SS     = (YP*CSP-XP*SNP)/D
      F      = SS/SB
      IF(F.GE.1.0001) GO TO 140
      IF(F.GT.(-.0001) .OR. FGE1) GO TO 200
C      F .LE.-.0001
      GO TO 150
C      F .GE. 1.0001
  140 FGE1   = .TRUE.
  150 CONTINUE

C     FAILED TO FIND PROPER BOUNDARY INTERSECTION
      APTD   = APT*TODEG
      WRITE (6,1950) NAMBDY,XPT,YPT,APTD

C     FIRST OR LAST INTERVAL
      LB     = LB1
      F      = .1
      IF(.NOT.FGE1) GO TO 165
      LB     = LB2
      F      = .9
  165 DZ     = ZBT(LB+3)-ZBT(LB)
      DR     = RBT(LB+3)-RBT(LB)
      WRITE (6,1960)

  200 ANGCHD= ATAN3(DR,DZ,ANGBT(LB))
      F      = AMAX1(0.,AMIN1(F,1.))
      G      = 1.-F
      YPA    = ANGBT(LB)-ANGCHD
      YPB    = ANGBT(LB+3)-ANGCHD
      RZONLY= .FALSE.
      CALL BFI
      I      = (LB-LB10+3)/3
      FA     = F
      S1     = S1M
      XB     = ZBT(LB)+ZM
```

```
      YB     = RBT(LB)*RM
      RZONLY= .TRUE.
      RETURN

 1950 FORMAT(/1X61HERROR- THE INTERSECTION OF A L.E. OR T.E. ORTHOGONAL
     *WITH THE/6X14HBOUNDARY, BDY=A6,40H, WAS NOT FOUND,  THE L.E./T.E.
     *POINT IS/6X2HX=F10.5,3X2HY=F10.5,4X4HANG=F8.3,)
 1960 FORMAT(/6X58HTHE INTERSECTION POINT IS BEING PLACED IN AN END INTE
     *RVAL,/6X24HEXECUTION WILL CONTINUE,)
      END
```

```
*DECK RBCONV
      SUBROUTINE RBCONV
*RBCONV          REBUILD CONVECTED PROPERTIES TABLE          @RBCONV@

C     COLLECT LIST OF CHANNELS FROM /CONVTB/, THEN BUILD A
C     NEW /CONVTB/ FROM CHANNEL DATA TO ACCOUNT FOR INPUT MODIFICATIONS

C     TABLE OF CONVECTED PROPERTIES
C      INDEX- LT=LTO,LTE
C      CH     = CHANNELNAME
C      LTNEXT= INDEX INCREMENT TO THE NEXT CHANNEL
C      LPSI   = RELATIVE LOCATION OF PSI LIST
C      NPT    = NO. OF PSI, TT, PT AND RCU VALUES
C      LTT    = RELATIVE LOCATION OF TT LIST
C      LPT    = RELATIVE LOCATION OF PT LIST
C      LRCU   = RELATIVE LOCATION OF RCU LIST
      COMMON /CHDATA/ CH(1),LTNEXT(1),NPT(1),LPSI(1),LTT(1),LPT(1),
     1                LRCU(1),
     2                CRG(1),CPGJ(1),C2CP(1),QGAM(1),FGT(1),FGP(1),
     3                FGR(1),AREATB(485)
       INTEGER CH
      DIMENSION XCH(1)
      EQUIVALENCE (CH,XCH)
C
      COMMON /IXORIG/ LHO,LHE, LBDO,LBDE, LTO,LTE, LWO,LWE, LFO,LFE,
     *                LO,LESTA,  LDUM(8),
     *                MO,NM, NJ,NFCOLS, MAXNJ,MAXOL,MAXNM,MAXLE,
     *                LEO,LEE, LRO,LRE,LRD
       DIMENSION      LIMITS(24)
      COMMON /SLTAB / W(128),X2(128),SLCHN(128)
       INTEGER SLCHN

      COMMON /CFB2  / PASS1
       LOGICAL        PASS1
      COMMON /ERASE2/ CHT(500),AT(500),FLW(500)
      COMMON /SPACER/ MAXLH,MAXLT,MAXLF,MAXLW

       INTEGER        CHT

C     ACCUMULATE CHANNEL NAMES AND AREAS
      LT     = LTO
      I      = 0
  110 I      = I+1
      CHT(I)= CH(LT)
      AT(I) = AREATB(LT)
      LT1    = LT+LPSI(LT)+NPT(LT)-1
      FLW(I)= XCH(LT1)
      LT     = LT+LTNEXT(LT)
      IF(LT.LT.LTE) GO TO 110
      NI     = I

C     CYCLE THROUGH BCONV ROUTINE
      PASS1 = .FALSE.
      LTE    = LTO-1
      I      = 1
  130 CALL BCONV(CHT(I),LT,AT(I))
C      CHECK FOR CHANGED FLOW RATE
      LT     = LT+LPSI(LT)+NPT(LT)-1
      IF(XCH(LT).EQ.FLW(I)) GO TO 190
C       UPDATE THE STREAMLINE TABLE FLOW VALUES
C         SEARCH FOR FIRST AND LAST ELEMENTS OF SLCHN(J)=CHT(I)
        DO 140 JA=1,NJ
```

```
  140     IF(SLCHN(JA).EQ.CHT(I)) GO TO 150
  150     DO 160 J=JA,NJ
          IF(SLCHN(J).NE.CHT(I)) GO TO 170
  160     JB     = J
C          SCALE THE CUMULATIVE FLOW RATE VALUES
  170    DO 180 J=JA,JB
  180     W(J)   = W(J)/W(JB)*XCH(LT)
C       SET PASS1=T TO JUMP AROUND INTERPOLATION FOR VM IN FLOBAL
C     (TYPE=FIELD)
       PASS1 = .TRUE.
  190  I      = I+1
       IF(I.LE.NI) GO TO 130

       IF(LTE.LT.LWO) GO TO 980
       WRITE (6,1960) LTO,LTE,MAXLT,LWO
       CALL ERROR1

  980  RETURN
 1960  FORMAT(/1X69H***  THE TABLE OF CONVECTED PROPERTIES HAS EXCEEDED A
      *LLOCATED MEMORY,/6X4HLTO=I4,3X4HLTE=I4,3X6HMAXLT=I4,3X4HLWO=I4,)
       END
```

```
*DECK RTCFI
      SUBROUTINE RTCFI(CHT1,LH)
*RTCFI-          RETRIEVE CHANNEL FLOW INPUT                         *RTCFI*

C     INPUT-
C      CHDATA= CHANNEL INPUT DATA TABLE
C      CHT1  = CHANNEL NAME

C     OUTPUT-
C      LH     = INDEX OF CHT1 IN THE CHANNEL DATA TABLE
C             = 0  IF NO CHANNEL DATA WAS FOUND
C      IF THEY EXIST, THE CHDATA-LISTS TT,PT,RCU ARE TRANSFERRED TO THE
C      LISTS OF  TT,PT,RCU.  IF THEY DO NOT EXIST, TT,PT,RCU = BITS.

       INTEGER CHT1
C
C     CHANNEL INPUT DATA TABLE
C      INDEX- LH=LHO.LHE
      COMMON /CHDATA/ CHNAM(1),LHNEXT(1),WTFLOW(1),TTO(1),PTO(1),
     1                TSO(1),PSO(1),MACHO(1),AO(1),VARY(1),
     2                RG(1),GAM(1), NR(1),NC(1),TAB(6),
     4                BB(75)
       LOGICAL        VARY
       INTEGER CHNAM
       DIMENSION      VO(1)
       REAL           MACHO
       EQUIVALENCE    (VO,MACHO)
C
      COMMON /IXORIG/ LHO,LHE, LBDO,LBDE, LTO,LTE, LWO,LWE, LFO,LFE,
     *                LO,LESTA,  LDUM(8),
     *                MO,NM, NJ,NFCOLS, MAXNJ,MAXOL,MAXNM,MAXLE,
     *                LEO,LEE, LRO,LRE,LRD
       DIMENSION      LIMITS(24)
       EQUIVALENCE    (LIMITS,LHO)

      COMMON /CRITS / BITS,BLANK
      COMMON /ERASE/  QV(8),EDUM(72), A(90),V(90),
     1                PSI(90),R(90),TT(90),PT(90),RCU(90),PS(90)
       DIMENSION      Y(90)
       EQUIVALENCE    (Y,R)

      NAMELIST /NLCHN / PSI,R,Y,TT,PT,RCU,PS

C     SEARCH CHDATA FOR CHANNEL=CHT1
      LH     = LHO
   60 IF(LH.GE.LHE) GO TO 65
      IF(CHNAM(LH).EQ.CHT1) GO TO 70
      LH     = LH+LHNEXT(LH)
      GO TO 60

C     NO INPUT TABLE WAS FOUND
   65 LH     = 0
      RETURN

C     AN INPUT TABLE WAS FOUND
   70 CONTINUE

C     PLACE THE TABLE IN COMMON-ERASE
      NCR    = NC(LH)*NR(LH)
      IF (NCR.GT.0) CALL ISORT(TT,PT,RCU, BB(LH),NCR)
      RETURN
      END
```

```
*DECK PPLOT
      OVERLAY(STC,1,4)
      PROGRAM PPLOT
*PPLOT          DUMMY TO CALL PRTPLT
      CALL PRTPLT
      RETURN
      END
```

```
*DECK PRTPLT
      SUBROUTINE PRTPLT
*PRTPLT          PRINTER PLOT

      COMMON /CBITS /  BITS,BLANK

      COMMON /CHDATA/ BDT(1),LBNEXT(1),LBZ1(1),CHNAME(1),UP(1),
     &                LEDEX(1),ZBT(1),RBT(1),ANGBT(3)
       DIMENSION      X1(1),LNEXT(1),MLB(1),MUB(1),PRIM(1),TYPELB(5),
     &                TYPEUB(1)
       EQUIVALENCE (X1,BDT),(LBNEXT,LNEXT),(MLB,LBZ1),(MUB,CHNAME),
     &            (PRIM,UP),(TYPELB,LEDEX),(TYPEUB,ANGBT(3))
      COMMON /SLTAB / W(128),X2(128),SLCHN(128)
      COMMON /CR    /  R(300)
      COMMON /CM    /  JMS(300)
      COMMON /CZ    /  Z(300)
      COMMON /CIDEX /  M,JDUM,MU,MD,ISTAG
      COMMON /IXORIG/  LHO,LHE, LBDO,LBDE, LTO,LTE, LWO,LWE, LFO,LFE,
     1                 LO,LESTA, LSO,LSE, LDO,LDE, LDUM(4),
     2                 MO,NM,NJ,NFCOLS(10)

      COMMON /PRNTP /  P(131,48)
      INTEGER          P,PLUS
      COMMON /PRNTP1/  RSV(20),ZSV(20)
      COMMON /PRNTP2/  LB1,LB2,I,II,ISV,I1,I2, K,KK,KSV,K1,K2, IP,IP1,
     1                 IP2,IP3, RI, IGO, XMIN,XMAX,XFACT,YMIN,YMAX,YFACT

C
      DIMENSION     ITABLE(10)
C
      LOGICAL          ISTGSV
      INTEGER          TE
      DATA  LE,TE/2HLE,2HTE/
      DATA PLUS/10H+
      DATA (ITABLE(I),I=1,10)/10H0           ,10H1          ,10H2          ,
     + 10H3         ,10H4          ,10H5          ,10H6          ,10H7
     +    ,10H8          ,10H9          /

C  SEARCH FOR MAX AND MIN, SET SCALES
C  YFACT AND XFACT  CHAR/UNIT
      YMAX   = R(NM)
      YMIN   = R(1)
      XMAX   = Z(NM)
      XMIN   = Z(1)
      DO 110 I=2,NM
      YMAX   = AMAX1(YMAX,R(I))
      YMIN   = AMIN1(YMIN,R(I))
      XMAX   = AMAX1(XMAX,Z(I))
      XMIN   = AMIN1(XMIN,Z(I))
  110 CONTINUE
      YFACT  = (YMAX-YMIN)/8.
      XFACT  = (XMAX-XMIN)/13.
      YFACT  = AMAX1(YFACT,XFACT)
      XFACT  = YFACT
      YFACT  = 6./YFACT
      XFACT  = 10./XFACT

C  INITIALIZE P ARRAY
      CALL SETM(1,BLANK,P,6288)


C  FILL IN BOUNDARIES UNTIL BDYTAB EXHAUSTED
```

```
      LB      = LBDO
  130 IF (LB.GE.LBDE) GO TO 200
      LB1     = LB+LBZ1(LB)
      LB2     = LB+LBNEXT(LB)-9
      I       = INT((ZBT(LB1)-XMIN)*XFACT)+1
      K       = INT((RBT(LB1)-YMIN)*YFACT)+1
      IF (I.GT.131) I=131
      IF (I.LT.1) I=1
      IF (K.GT.48) K=48
      IF (K.LT.1) K=1
      P(I,K) = PLUS
      ISV     = I
      KSV     = K
      LB3     = LB1+3
      DO 190 L=LB3,LB2,3
      I       = INT((ZBT(L)-XMIN)*XFACT)+1
      K       = INT((RBT(L)-YMIN)*YFACT)+1
      IF (I.GT.131) I=131
      IF (I.LT.1) I=1
      IF (K.GT.48) K=48
      IF (K.LT.1) K=1
      P(I,K) = PLUS
      IF (IABS(I-ISV).LE.1) GO TO 150
C  INTERPOLATE
      I1      = MIN0(I,ISV)
      I2      = MAX0(I,ISV)
      II      = I1
  140 II      = II+1
      IF (II.EQ.I2) GO TO 180
      KK      = K-((K-KSV)*(I-II)/(I-ISV))
      P(II,KK) = PLUS
      GO TO 140
  150 IF (IABS(K-KSV).LE.1) GO TO 180
      I1      = MIN0(I,ISV)
      I2      = MAX0(I,ISV)
      K1      = MIN0(K,KSV)
      K2      = MAX0(K,KSV)
      KSV     = (K2-K1)/2 + K1
      DO 160 KK=K1,KSV
  160 P(I1,KK) = PLUS
      KSV     = KSV +1
  170 P(I2,KK) = PLUS
  180 ISV     = I
      KSV     = K
  190 CONTINUE
      LB      = LB+LBNEXT(LB)
      GO TO 130

  200 CONTINUE


C  ADD OL TO PLOT
  300 LS      = LO
  305 IF (LS.GT.LESTA) GO TO 500
      IP      = X1(LS)
      IP1     = IP
      IF (IP.LT.10) GO TO 320
      IF (IP.LT.100) GO TO 310
      IP3     = IP1/100
      IP1     = IP1-IP3*100
      IP3     = ITABLE(IP3+1)
  310 IP2     = IP1/10
```

```
      IP1      = IP1-IP2*10
      IP2      = ITABLE(IP2+1)
  320 IP1      = ITABLE(IP1+1)
      L1       = MLB(LS)
      L2       = MUB(LS)
      I        = INT((Z(L1)-XMIN)*XFACT)+1
      K        = INT((R(L1)-YMIN)*YFACT)+1
      IGO      = 1
      GO TO 400
  330 L1       = L1+1
      IF (L1.GT.L2) GO TO 380
      ISV      = I
      KSV      = K
      I        = INT((Z(L1)-XMIN)*XFACT)+1
      K        = INT((R(L1)-YMIN)*YFACT)+1
      IGO      = 2
      GO TO 400
  350 IF (IABS(K-KSV).LE.1) GO TO 330
      K1       = MIN0(K,KSV)
      K2       = MAX0(K,KSV)
      I1       = ISV
      IF (K1.EQ.K) I1=I
      I2       = ISV
      IF (K2.EQ.K)I2=I
      I        = I1
      K        = K1
      IGO      =3
  360 K        = K+1
      I        = I1 + FLOAT((I2-I1)*(K-K1))/FLOAT(K2-K1)
      IF (K.GE.K2) GO TO 330
      GO TO 400
  380 LS       = LS+LNEXT(LS)
      GO TO 305
  400 P(I,K) = IP1
      IF (IP.GE.10 .AND. I.GT.1) P(I-1,K)=IP2
      IF (IP.GE.100 .AND. I.GT.2) P(I-2,K)=IP3
      GO TO (330,350,360),IGO

C  ADD SL TO PLOT
C  LOCATE FIRST PT ON SL
  500 J        = 0
  510 J        = J+1
      IF (J.GT.NJ) GO TO 800
      M        = MBEGIN(J)
      ISTGSV = .FALSE.

C  SAVE COORDS OF SL SEGMENT
  520 L        = 1
  530 RSV(L) = R(M)
      ZSV(L) = Z(M)
      CALL GETIX
      IF (ISTAG.NE.1) GO TO 534
      LR       = 0
      CALL STANO(M,LR,UPPER)
      IF (TYPELB(LR).EQ.LE .OR. TYPEUB(LR).EQ.LE) GO TO 550
  534 IF (MD.EQ.0 .AND. ISTGSV) GO TO 550
      IF (MD.EQ.0) GO TO 510
      IF (ISTAG.NE.2) GO TO 538
      LR       = 0
      CALL STANO(M,LR,UPPER)
      IF (TYPELB(LR).EQ.TE .OR. TYPEUB(LR).EQ.TE) GO TO 540
```

```
538 M          = MD
    L          = L+1
    GO TO 530
540 ISTGSV     = .TRUE.
    RSV(1)     = R(M)
    ZSV(1)     = Z(M)
    L          = 2
    M          = MD
    GO TO 530

C  DETERMINE X2
550 LTOT       = L
    IP         = X2(J)
    IP1        = IP
    IDIGIT     = 1
    IF (IP.LT.10) GO TO 570
    IF (IP.LT.100) GO TO 560
    IDIGIT     = 3
    IP3        = IP1/100
    IP1        = IP1-IP3*100
    IP3        = ITABLE(IP3+1)
560 IDIGIT     = 2
    IP2        = IP1/10
    IP1        = IP1-IP2*10
    IP2        = ITABLE(IP2+1)
570 IP1        = ITABLE(IP1+1)

610 I          = INT((ZSV(1)-XMIN)*XFACT)+1
    K          = INT((RSV(1)-YMIN)*YFACT)+1
    L          = 1
    IGO        = 1
    GO TO 700
620 L          = L+1
    IF (L.LE.LTOT) GO TO 630
    IF (MD.EQ.0) GO TO 510
    M          = MD
    GO TO 520
630 ISV        = I
    KSV        = K
    I          = INT((ZSV(L)-XMIN)*XFACT)+1
    K          = INT((RSV(L)-YMIN)*YFACT)+1
    IGO        = 2
    GO TO 700

C  INTERPOLATE  (ASSUME ISV.LT.I)
640 IF (I-ISV.LE.IDIGIT) GO TO 620
    KK         = K
    II         = I
    I          = ISV
650 I          = I +IDIGIT
    K          = KK - FLOAT((KK-KSV)*(II-I))/FLOAT(II-ISV)
    IF (I.GE.II) GO TO 620
    IGO        = 3
    GO TO 700

700 P(I,K) = IP1
    IF (IP.GE.10 .AND. I.GT.1)    P(I-1,K)=IP2
    IF (IP.GE.100 .AND. I.GT.2)   P(I-2,K)=IP3
    GO TO (620,640,650),IGO


800 WRITE (6,1000)
```

```
      DO 810 KK=1,48
      K       = 49-KK
      WRITE (6,1001) (P(I,K),I=1,131)
  810 CONTINUE
  900 RETURN

 1000 FORMAT (1H1,55X,16HXI1,XI2 GRID MAP  //)
 1001 FORMAT ((1X,131A1))
      END
```

```
*DECK STCB
      OVERLAY(STC,2,0)
      PROGRAM STCB
      COMMON /CHNFRT/ ICHN(10),WTFS(10),WTFA(10),WPTO(10),WTTO(10), IC
      COMMON /SELECT/ LENTRY
      GO TO (10,20,10,10),LENTRY
C     NORMAL ENTRY-- STATION LOOP, FLOW BALANCE
   10 CALL OVERLAY(3HSTC,2,1,6HRECALL)
      GO TO 30
   20 CALL OVERLAY(3HSTC,2,2,6HRECALL)
   30 RETURN
      END
```

```
      BLOCK DATA CFBBLK
*CFB--*          BLOCK DATA FOR CFB                                     *CFB*
      COMMON /CFB    / L,MA,MB,PLB,PUB,WF,CHOKE,SUBSON, NK,PLBC,PUBC,
     1                 XCHOKE, TAREA,VMBC, WRQST,WCALC, QV(8),QVP(8),
     *                 JSUM,VMLBSQ
       LOGICAL                                CHOKE,SUBSON
      DATA XCHOKE/5HCHOKE/, JSUM/0/
      END
```

```
*DECK ERRORX
      SUBROUTINE ERROR1
CEDUMPX            EDUMP FOR STC EXECUTE SECTION                        *EDUMPX*

      LOGICAL              IPLOT
      COMMON /CHDATA/ TABLES(1),LNEXT(1),MLB(1),MUB(97)

      COMMON /ALLCOM/ MACHA(20)
      COMMON /CB    / B(300)
      COMMON /CCURV / CURV(300)
      COMMON /CDS2  / DS2(300)
      COMMON /CEDUMP/ IGODMP
      COMMON /CFB   / L,DFB(4),IB,DFB1(2),NK,DFB2(7),NIC,DFB3(17)
      COMMON /CIDEX / M,J,MU,MD,ISTAG
      COMMON /CLINES/ LINES,OMITFK,PTITLE(6)
       LOGICAL                 OMITFK
      COMMON /CM    / JMS(300)
      COMMON /CPHI1 / PHI1(300)
      COMMON /CPLOT1/ PLOT,SAMEXY(13)
       LOGICAL             PLOT
      COMMON /CR    / R(300)
      COMMON /CRHS  / RHS(300)
      COMMON /CS1   / S1(300)
      COMMON /CS2   / S2(300)
      COMMON /CTABPR/ I1TAB
      COMMON /CVM   / VM(300)
      COMMON /CZ    / Z(300)
      COMMON /ERASE2/ AREA(96),AREAO(96),DISP(96),PT(96),LAMBDA(96),
     &                RHO(96),SQRTVV(96),TS(96),TT(96),VMSQ(96),
     &                VVKQKP(96),
     &                WOA(96),WSTA(96), RG(96),C2CP(96),FGR(96)
       REAL           LAMBDA
       DIMENSION      ES2(96),SDNQRM(96)
       EQUIVALENCE    (ES2,VVKQKP),(SDNQRM,RHO)
       DIMENSION      RCU(96)
       EQUIVALENCE    (RCU,LAMBDA)
      COMMON /IXORIG/ LHO,LHE, LBDO,LBDE, LTO,LTE, LWO,LWE, LFO,LFE,
     &                LO,LESTA,LSO,LSE,LDUM(6),
     &                MO,NM, NJ,NFCOLS, MAXNJ,MAXOL,MAXNM,MAXLE,
     &                LEO,LEE, LRO,LRE,LRD
      COMMON /SLTAB / W(128),X2(128),SLCHN(128)
       INTEGER        SLCHN
      COMMON /BLBDY / IBLB(60)
      IPLOT = PLOT

      LMAX  = 0
  130 WRITE (6,1130)
      CALL TABPRT(3H    ,L,34,8)
      WRITE (6,1150) (J,X2(J),SLCHN(J),W(J),J=1,NJ)
      IF (LMAX) 180,140,180
  140 CALL TABPRT(6HALLCOM,MACHA,20,8)
      CALL TABPRT(5HCIDEX,M,5,5)
      CALL TABPRT(6HIXORIG,LHO,12,2)
      I1TAB = LBDO
      CALL TABPRT(6HBDYTAB,TABLES,LBDE,3)
      I1TAB = LTO
      CALL TABPRT(6HCONVTB,TABLES,LTE,7)
      I1TAB = LWO
      CALL TABPRT(6HWAKETB,TABLES,LWE,2)
      I1TAB = LFO
      CALL TABPRT(6HCADJWF,TABLES,LFE,8)
      I1TAB = LO
```

```
      CALL TABPRT(8HSTATAB,TABLES,LESTA,5)

C   FIELD TABLE DUMP
      L       = LO
      LMAX    = LESTA
  180 OMITFK= .TRUE.
      LINES = 64
  190 MA      = MLB(L)
      MB      = MUB(L)
      CALL FHEAD(MB-MA+2)
      IF (LINES.EQ.(MB-MA+5)) WRITE (6,1200)
      WRITE (6,1202)
      DO 200 M=MA,MB
      CALL GETIX
      WRITE (6,1201) J,M,MU,MD,ISTAG, S1(M),S2(M),Z(M),R(M),PHI1(M),
     &        CURV(M),VM(M),B(M),RHS(M),DS2(M)
  200 CONTINUE
      L       = L+LNEXT(L)
      IF(L.LE.LMAX) GO TO 190
      L       = LMAX

C   ERASE2 DUMP
  300 WRITE (6,1004)
      NIC     = MIN0(NIC,128)
      NK      = MIN0(NK,96)
      GO TO (900,310,330,350,360,370,390), IGODMP
C     FLOBAL
  310 WRITE (6,1000)
      DO 315 I=1,NK
      WRITE (6,1001) (AREA(J),J=I,672,96)
  315 CONTINUE
      WRITE (6,1002)
      DO 320 I=1,NK
      IP      = 672+I
      WRITE (6,1001) (AREA(J),J=IP, 1536,96)
  320 CONTINUE
      GO TO 900

  330 WRITE (6,1008)
      DO 335 I=1,NIC
      WRITE (6,1019) (AREA(J),J=I,768,128)
  335 CONTINUE
      WRITE (6,1005)
      DO 340 I=1,NK
      IP      = 768+I
      WRITE (6,1006) (AREA(J),J= IP,1344,96)
  340 CONTINUE
      GO TO 900

  350 WRITE (6,1007) (AREA(I),I=1152,1183)
      WRITE (6,1009)
      DO 355 I=1,NIC
      WRITE (6,1010) (AREA(J),J=I,1152,128)
  355 CONTINUE
      GO TO 900

C     SLC
  360 WRITE (6,1011) (AREA(I),I=1024,1037)
      WRITE (6,1012)
      DO 365 I=1,IB
  365 WRITE (6,1013) (AREA(J),J=I,1024,128)
```

```
      GO TO 900

  370 WRITE (6,1014)
      DO 375 I=1,NK
      WRITE (6,1001) (AREA(J),J=I,431,48)
  375 CONTINUE
      WRITE (6,1015)
      DO 380 I=1,NK
      WRITE (6,1001) (AREA(J),J=432,863,48)
  380 CONTINUE
      GO TO 900

  390 WRITE (6,1016)
      DO 392 I=1,50
      WRITE (6,1001) AREA(I),AREA(I+128),AREA(I+256),
     &               AREA(I+50),AREA(I+178),AREA(I+306),
     &               AREA(I+100),AREA(I+228),AREA(I+356)
  392 CONTINUE
      WRITE (6,1017) (AREA(I),I=385,896)
      WRITE (6,1018) (AREA(I),I=897,1308)
  900 CONTINUE

      IF( IBLB(1).NE.0 ) CALL TABPRT(5HBLBDY,IBLB,60,3)
      IF( LDE.EQ.0 ) GO TO 1321
      I1TAB = LDO
      CALL TABPRT(5HBLTAB,CHNAM,LDE,3)
 1321 CONTINUE

      LSTOP = 5
      GO TO (999,999) , LSTOP
  999 RETURN

      ENTRY EDUMP1
      LMAX  = L
      IPLOT = .FALSE.
      GO TO 130

 1000 FORMAT (//2X,47HSUBROUTINES ADJWF, BRHS, FLOBAL, WRIBDY, WRIOUT//
     &        11X,4HAREA,8X,5HAREAO,9X,4HDISP,11X,2HPT,7X,6HLAMBDA,10X,
     &        3HRHO,7X,6HSQRTVV)
 1001 FORMAT (2X,9E13.5)
 1002 FORMAT (//13X,2HTS,11X,2HTT,9X,4HVMSQ,7X,6HVVKQKP,10X,3HWQA,9X,
     &        4HWSTA,11X,2HRG,9X,4HC2CP,10X,3HEGR)
 1003 FORMAT (//2X,17HSUBROUTINE PTMOVE// 12X,3HX1L,11X,2HSC,10X,3HSCX,
     &        11X,2HLC,8X,5HLOOPC,10X,3HKCL)
 1004 FORMAT (1H1)
 1005 FORMAT (//11X,4HPHI2,10X,3HDS1,11X,2HZK,11X,2HRK,2X,5HWEZPT,
     &        9X,4HDS1C)
 1006 FORMAT (2X,4E13.5,5X,L2,E13.5)
 1007 FORMAT (//2X,17HSUBROUTINE REFINE//2X,3HIA=,16I7/2X,3HIB=,16I7)
 1009 FORMAT (//13X,2HCR,9X,4HDELS,8X,5HDELVM,2X,4HLSTA,3X,3HMJ2,10X,
     &        3HSGX,10X,3HSGY,10X,3HRAV,10X,3HZAV)
 1010 FORMAT (2X,3E13.5,2I6,4E13.5)
 1011 FORMAT (//2X,14HSUBROUTINE SLC//2X,6HCURSS=,6E13.5/
     &        2X,6HQV   =,8E13.5)
 1012 FORMAT (//13X,2HRB,11X,2HZB,10X,3HANG,8X,5HCURVB,10X,3HS1B,11X,
     &        2HBI,2X,6HJ2DONE,3X,3HMSV)
 1013 FORMAT (2X,6E13.5,2X,2I6)
 1014 FORMAT (//2X,14HSUBROUTINE OLC//13X,2HZK,11X,2HRK,8X,5HWEZPT,
     &        9X,4HPHI2,11X,2HC2,11X,2HSP,10X,3HSPP,10X,3HGSP,9X,4HGSPP)
 1015 FORMAT (//13X,2HDS,10X,3HBET,10X,3HDDS,9X,4HWSTA,9X,4HDISP,11X,
```

```
     &         2HTT,11X,2HPT,9X,4HC2CP,10X,3HPGR)
1016 FORMAT (//2X,26HSUBROUTINES ADDPTB, PLOTRZ//11X,4HANGB,11X,2HRB,
     &         11X,2HZB)
1017 FORMAT (/2X,2HRR/(2X,10E13.5),)
1018 FORMAT (/2X,2HZZ/(2X,10E13.5),)
1019 FORMAT (2X,3E13.5,3I13)
1130 FORMAT(//1X,3HCFB,3X,9H1-L,MA,MB,3X,25H4-PLB,PUB,WF,CHOKE,SUBSON,
    &3X,44H9-NK,PUBC,PUBC,XCHOKE,TAREA,VMBC,WRQST,WCALC,
    &5X,32H17-QV(8),QVP(8)    33-JSUM,VMLBSQX)
    & "        17-QV(8),QVP(8)    33-JSUM,VMLBSQ")
1150 FORMAT(///1X17HSTREAMLINE TABLE-/17X32HJ       X2            SLCHN
     &      W/(I18,F12.6,6X,A6,F12.6,),)
1200 FORMAT(57X,16HFIELD TABLE DUMP/128H    J     M    MU    MD I    S1
     &     S2             Z             R             PHI1          CURV              V
    &M             B        RHS          DS2)
1201 FORMAT (1X,I5,3I5,I2,2F11.6,2F12.6,F11.6,F12.7,2F11.3,2F10.5)
1202 FORMAT(1H )
     END
```

```
*DECK ADJWF2
      SUBROUTINE ADJWF2
*ADJWF2          INSERT CHOKE STATION IN FLOW ADJ-TABLE      *ADJWF2*

C   COMB3
C    CADJWF, CHDATA, STATAB
      COMMON /CHDATA/ CHNAM(1),LHNEXT(1),WTFLOW(1),TTO(1),PTO(1),
     *                TSO(1),PSO(1),MACHO(1),AO(1),VARY(5),TAB(6)
       INTEGER        CHNAM
       LOGICAL                                VARY
C     FLOW ADJUSTMENT TABLE
C      INDEX- LF=LFO,LFE
C      NFCOLS= 8
C      X1F    = ORTHOGONAL COORDINATE
C      X2F    = STREAMLINE COORDINATE OF SL EMINATING FROM T.E.
C      X1BF   = X1-COORDINATE OF CHOKE STATION OF FLOW BELOW T.E.
C      X1AF   = X1-COORDINATE OF CHOKE STATION OF FLOW ABOVE T.E.
C      S1F    = S1-COORDINATE OF T.E. (UPPER SURFACE), THIS ITEM
C               IS USED WHEN INTERPOLATING FOR WAKE DELTA-STAR.
C      LFB,LFA=INDICES OF STATIONS BELOW AND ABOVE T.E.
C      NCHB,NCHA=NUMBER OF CHANNELS BELOW AND ABOVE T.E.
C      LRF    = INDEX OF DUMMY ORTCHN LIST FOR THE T.E.
C      LRXF   = INDEX OF LAST CHANNEL BELOW THE T.E.
C      JORDER= 0 IF TOTAL FLOW AT X1F IS GIVEN
C             = 2 IF FLOW ABOVE T.E. IS GIVEN
C             = 1 IF FLOW BELOW T.E. IS GIVEN
C      JORDER= -1 IF FLOW AT X1F IS CHOKED AND SINGLE CHANNEL
       DIMENSION        X1F(1),X2F(1),X1BF(1),X1AF(1),
     1                  S1F(1),NCHB(1),NCHA(1),JORDER(1),VNR(12)
       EQUIVALENCE    (LFB,X1BF),(LFA,X1AF),(LRF,NCHB),(LRXF,NCHA)
       DIMENSION      LFB(1),LFA(1),LRF(1),LRXF(1)
C     STATION TABLE
C      INDEX- L=LO,LESTA
C      SCHOKE= STATION CHOKE INDICATOR (ADJWF,BRHS,WRIOUT)
C      MCL    = SHARP CORNER INDICATOR (BLDTBS)
C      MCL    = FIELD INDEX OF CONTROL STREAMLINE (PTMOVE,FLOBAL)
       DIMENSION        X1(1),LNEXT(1),MLB(1),MUB(1),PRIM(1),
     1                  TYPELB(1),NAMELB(1),ILB(1),FLB(1),S1LB(1),
     1                  TYPEUB(1),NAMEUB(1),IUB(1),FUB(1),S1UB(1),
     &                  VMB(1),DWDV(1),X2CL(1),SLSWI(1),MCL(1),
     &                  ANGTE(1),PTTE(1),PSTE(1),FGRTE(1),RGTE(1),
     &                  ANGEXP(1),BSQEXP(475)
        DIMENSION       CRVLE(1),ANGLE(1)
        EQUIVALENCE     (SCHOKE,DWDV),(CRVLE,ANGTE),(ANGLE,PTTE)
        INTEGER         PRIM,TYPELB,TYPEUB,SCHOKE(1)
      EQUIVALENCE    (CHNAM,X1F,X1), (LHNEXT,X2F,LNEXT)
      EQUIVALENCE    (WTFLOW,X1BF,MLB), (TTO,X1AF,MUB), (PTO,S1F,PRIM)
      EQUIVALENCE    (TSO,NCHB,TYPELB), (PSO,NCHA,NAMELB)
      EQUIVALENCE    (MACHO,JORDER,ILB), (AO,VNR,FLB), (VARY(1),S1LB)
      EQUIVALENCE    (VARY(2),TYPEUB), (VARY(3),NAMEUB), (VARY(4),IUB)
      EQUIVALENCE    (VARY(5),FUB)
       EQUIVALENCE    (TAB(1),AREATB,S1UB), (TAB(2),VMB), (TAB(3),DWDV)
       EQUIVALENCE    (TAB(4),X2CL),(TAB(5),SLSWI),(TAB(6),MCL)
C
      COMMON /CFB    / L,MA,MB,PLB,PUB,WF,CHOKE,SUBSON, NK,PLBC,PUBC,
     1                 XCHOKE, TAREA,VMBC, WRQST,WCALC, QV(8),QVP(8),
     *                 JSUM,VMLBSQ
       LOGICAL                              CHOKE,SUBSON
      COMMON /CSS    / SSFML,SSEF,SSEANG,SSDF,SSFEND,SSFND1
     1               ,SSDLE,A4FACT,BRLX,CURRLX
       INTEGER         SSFML
       LOGICAL                SSEF,          SSDF,    SSDLE
```

```
C       SSFML  = SUPERSONIC CURVATURE FORMULA NUMBER
C       SSEF   = SUPERSONIC ENTERING FLOW, T OR F
C       SSEANG= ENTERING FLOW ANGLE (DEGREES) FOR SSEF=T
C       SSDF   = SUPERSONIC DISCHARGE FLOW, T OR F
C       SSFEND= SUPERSONIC BEAM DOWNSTREAM END CONDITION, =0,1 FOR PARABOL
C       SSFND1= SUPERSONIC BEAM UPSTREAM END CONDITION, =0,1, FOR PARABOLA
C       SSDLE  = SS FLOW BELOW AND AFT OF LE PT, T OR F
C       A4FACT= CENTRAL POINT INFLUENCE COEFFICIENT FACTOR
C       BRLX   = B-RELAXATION FACTOR
C       CURRLX= CURVATURE RELAXATION FACTOR
        COMMON /IXORIG/ LHO,LHE, LBDO,LBDE, LTO,LTE, LWO,LWE, LFO,LFE,
     *                  LO,LESTA,  LDUM(8),
     *                  MO,NM, NJ,NFCOLS, MAXNJ,MAXOL,MAXNM,MAXLE,
     *                  LEO,LEE, LRO,LRE,LRD
         DIMENSION      LIMITS(24)
         EQUIVALENCE    (LIMITS,LHO)
        COMMON /SLTAB / W(128),X2(128),SLCHN(128)
         INTEGER SLCHN

        COMMON /CIDEK / M,J,MU,MD,ISTAG

C      CHECK FOR SMALLER PREVIOUSLY DECTECTED AREA
        M      = MLB(L)
        CALL GETIX
        JA     = J
        M      = MUB(L)
        CALL GETIX
        JB     = J
        JSUML  = JA+256*JB
        IF(JSUM.NE.JSUML) GO TO 90
        IF(TAREA.GT.SVAREA) RETURN
   90   JSUM   = JSUML
        SVAREA= TAREA
        IF(SSDF) SUBSON=.FALSE.

C      SEARCH FORWARD TO TRAILING EDGE
        LX     = L
        LSTE   = 0
  105   IF(.NOT.PRIM(LX)) GO TO 110
        M      = MLB(LX)
        CALL GETIX
        IF(J.NE.JA) GO TO 115
        M      = MUB(LX)
        CALL GETIX
        IF(J.NE.JB) GO TO 115
        LSTE   = LX
  110   LX     = LX+LNEXT(LX)
        IF(LX.LT.LESTA) GO TO 105
  115   IF(LSTE.EQ.0) GO TO 800

C      SEACH CADJWF-TABLE FOR T.E. VALUE OF X1
        LF     = LFO
  120   IF(LF.GE.LFE) GO TO 200
        IF(X1F(LF).EQ.X1(LSTE)) GO TO 125
        LF     = LF+NFCOLS
        GO TO 120

C      IS THE L=ORTHOGONAL BELOW OR ABOVE THE BODY
C       (BELOW THE BODY)
  125   IF(X2(JB).EQ.X2F(LF)) X1BF(LF)=X1(L)
C       (ABOVE THE BODY)
```

```
      IF(X2(JA).EQ.X2F(LF)) X1AF(LF)=X1(L)
      RETURN
C     CHOKED CHANNEL W/O T.E., ADD A LINE TO /CADJWF/
  200 LF     = LFE+1
      IF(LF.NE.LO) GO TO 205
      NMOVE = LO-LESTA-1
      LO     = LO+NFCOLS
      CALL MOVE(1, X1(LF),X1(LO),NMOVE,1)
      CALL SETM(1,0, X1F(LF),NFCOLS)
      L      = L+NFCOLS
      LSTE   = LSTE+NFCOLS
      LESTA  = LESTA+NFCOLS
      LFE    = LFE+NFCOLS
  205 X1F(LF)=X1(LSTE)
      X2F(LF)=X2(JA)
      X1AF(LF)=X1(L)
      X1BF(LF)=X1F(LF)
      JORDER(LF)=-1
C     WRITE COMMENT
  800 WRITE (6,1800) X1(L),L
 1800 FORMAT(/1X32HUNEXPECTED CHOKE,  STATION(XI1)=F6.3,4X2HL=I4,/
      IF(LSTE.EQ.0) CALL ERROR1
      RETURN
      END
```

```
*DECK FLOBAL
      SUBROUTINE FLOBAL
*FLOBAL          FLOW BALANCE ROUTINE                               @FLOBAL@
C      INTEGRATION OF THE CONTINUITY AND NORMAL MOMENTUM EQUATIONS
C      ALONG THE ORTHOGONALS TO THE STREAMLINES
C     INPUT-
C      L      = INDEX IN THE STATION TABLE
C      PLB    = LOWER BOUNDARY STATIC PRESSURE IF KNOWN,
C      PUB    = UPPER BOUNDARY STATIC PRESSURE IF KNOWN,
C               (EITHER PLB OR PUB OR BOTH MUST BE ZERO.
C               IF PLB (OR PUB) =-1. NO ITERATION FOR FLOW OR
C               LOWER BOUNDARY PRESSURE IS PERFORMED.)
C      WF     = FLOW RATE IF KNOWN (OVERRIDES VALUE OF WSTA)
C      CHOKE  = T FOR CALCULATION OF MAX FLOW .
C      S2(M)  = DISTANCE ALONG THE ORTHOGONOL
C      CURV(M)=STREAMLINE CURVATURE
C      STATION TABLE
C      VMB(L)= ESTIMATED VELOCITY ON THE UPPER BOUNDARY
C      DWDV(L)=DERIVATIVE OF THE AREA INVERSE WITH RESPECT TO BOUNDARY VE
C      STREAMLINE TABLE
C     OUTPUT-
C      PLBC   = CALCULATED LOWER BOUNDARY PRESSURE, M=MA
C      PUBC   = CALCULATED UPPER BOUNDARY PRESSURE, M=MB
C      TAREA  = TOTAL PASSAGE AREA FOR ALL STREAMTUBES
C      WCALC  = CALCULATED FLOW
C      WRQST  = REQUESTED FLOW (SLTAB DATA)
C      VMBC   = CALCULATED VELOCITY ON THE UPPER BONNDARY
C      DWDV(L)=DERIVATIVE OF THE AREA INVERSE WITH RESPECT TO BOUNDARY VE
C      VCL(L)= VELOCITY ON THE CONTROL STREAMLINE
C      PLB,PUB=0.  (RESET FOR NEXT ENTRY)
C     STATION TABLE
C      INDEX- L=LO,LESTA
C      SCHOKE= STATION CHOKE INDICATOR (ADJWF,BRHS,WRIOUT)
C      MCL    = SHARP CORNER INDICATOR (BLDTBS)
C      MCL    = FIELD INDEX OF CONTROL STREAMLINE (PTMOVE,FLOBAL)
      COMMON /CHDATA/ X1(1),LNEXT(1),MLB(1),MUB(1),PRIM(1),
     1                TYPELB(1),NAMELB(1),ILB(1),FLB(1),S1LB(1),
     1                TYPEUB(1),NAMEUB(1),IUB(1),FUB(1),S1UB(1),
     &                VMB(1),DWDV(1),X2CL(1),SLSWI(1),MCL(1),
     &                ANGTE(1),PTTE(1),PSTE(1),FGRTE(1),RGTE(1),
     &                ANGEXP(1),BSQEXP(475)
       DIMENSION      CRVLE(1),ANGLE(1)
       EQUIVALENCE    (SCHOKE,DWDV),(CRVLE,ANGTE),(ANGLE,PTTE)
       INTEGER        PRIM,TYPELB,TYPEUB,SCHOKE(1)

      COMMON /ALLCOM/ MACHA,PSA,TSA,PTA,TTA, AXIA,RGA,GAMA,
     &                MACHC,PSC,TSC,PTC,TTC, AXIC,RGC,GAMC,
     &                DAXIT,SCALEA,TTE,CHOTST
       REAL           MACHA,MACHC
       LOGICAL        AXIA,AXIC,CHOTST
      COMMON /CB    / B(300)
      COMMON /CBITS / BITS,BLANK
      COMMON /CCURV / CURV(300)
      COMMON /CEDUMP/ IGODMP
      COMMON /CFB   / L,MA,MB,PLB,PUB,WF,CHOKE,SUBSON, NK,PLBC,PUBC,
     &                XCHOKE, TAREA,VMBC, WRQST,WCALC, QV(8),QVP(8),
     &                JSUM,VMLBSQ
```

```
      INTEGER          XCHOKE
      LOGICAL                                CHOKB,SUBSON
      DIMENSION        S1B(4),V1B(4)
      EQUIVALENCE      (S1B,QV),(V1B,QV(5))
      COMMON /CFB2   / PASS1
      LOGICAL          PASS1
      COMMON /CFRFIN/  ATINF,MINF,RFFINF,UINF,ZDN1,ZDN25
      COMMON /CFRFLD/  NFF(130),ZDN(50),UDN(25)
      COMMON /CIDEX /  M,J,MU,MD,ISTAG
      COMMON /CIDEXR/  M4,CI1(4),M3,CI2(4),M5,CI3(4),M2,CI4(4),M6,CI5(4)
      COMMON /CISBOT/  CISDUM(4),IPRES(2),PSPISV,NZP,
     &                 ZP(10),PSP(10),NZP1
      INTEGER          PSPISV
      COMMON /CIVP   / IVP,VPDUM,NRF(2),INR(2),XIVP(2),MXLRLX
      COMMON /CLSPF  / I,LEND
      LOGICAL            LEND
      COMMON /CMAXIT/  MAXREF,NREFIN,GREFIN,TL
      COMMON /CPI    / PI,TWOPI,PIO2,PIO4,TODEG,TORAD
      COMMON /CPRINT/  PRTES2(6),PDUM(20)
      COMMON /CPTMOV/  VELPOT,ICOB,NODENS,FBASTG
      COMMON /CQIREM/  YTOL,YO,DYDX,CTRMAX
      COMMON /CR     / R(300)
      COMMON /CS1    / S1(300)
      COMMON /CS2    / S2(300)
      COMMON /CTABPR/  I1TAB
      COMMON /CVM    / VM(300)
      COMMON /CZ     / Z(300)
      COMMON /ERASE2/  AREA(96),AREAO(96),DISP(96),PT(96),LAMBDA(96),
     &                 RHO(96),SQRTVV(96),TS(96),TT(96),VMSQ(96),
     &                 VVKQKP(96),
     &                 WGA(96),WSTA(96), RG(96),C2CP(96),FGR(96)
      REAL             LAMBDA
      DIMENSION        ES2(96),SDNQRM(96)
      EQUIVALENCE      (ES2,VVKQKP),(SDNQRM,RHO)
      DIMENSION        RCU(96)
      EQUIVALENCE      (RCU,LAMBDA)
      DIMENSION        RLAMDA(96)
      EQUIVALENCE      (RLAMDA,AREA)
      COMMON /IXORIG/  LHO,LHE, LBDO,LBDE, LTO,LTE, LWO,LWE, LFO,LFE,
     &                 LO,LESTA,LSO,LSB,LDUM(6),
     &                 MO,NM, NJ,NFCOLS, MAXNJ,MAXOL,MAXNM,MAXLE,
     &                 LEO,LEE, LRO,LRE,LRD
      COMMON /SLTAB /  W(128),X2(128),SLCHN(128)
      INTEGER          SLCHN
      COMMON /SLTAB2/  PTR(128)

      INTEGER          FARFLD,FREE,PRES,FIELD,SOLID,TE
      LOGICAL          WAKE


      DATA FARFLD/6HFARFLD/, FREE/4HFREE/, PRES/4HPRES/, FIELD/5HFIELD/
      DATA SOLID/5HSOLID/, TE/2HTE/

      IGODMP= 2
  500 MA     = MLB(L)
      MB     = MUB(L)
      IF(L.EQ.LO) CALL SETM(1,1., PTR,NJ)

C     CHECK FOR HARD STAG PT (ISTAG=3 AT PT NEXT TO BDY)
      M      = MA
      CALL GETIX
```

```
      IF(ISTAG=1) 510,503,510
  503 M        = MA+1
      CALL GETIX
      IF(ISTAG=3) 510,505,510
  505 MA       = M
  510 M        = MB
      CALL GETIX
      IF(ISTAG=1) 520,513,520
  513 M        = MB-1
      CALL GETIX
      IF(ISTAG=3) 520,515,520
  515 MB       = M

C     BUILD TABLE OF FLOW FUNCTION AND STAGNATION CONDITIONS
  520 CALL TTPT(MA,MB, WSTA,DISP,WAKE,TT,PT,LAMBDA, RG,C2CP,FGR)

C     CHECK FOR OLC OPTION
      MOMEQ = 1
      IF(SLSWI(L).NE.0. .AND. SLSWI(L).NE.1.) MOMEQ=0

C     PASSAGE AREA AND SHOCK PRESSURE LOSS
      K        = 1
      M        = MA
  522 RLAMDA(K)=LAMBDA(K)
      IF(AXIA) RLAMDA(K)=TWOPI*R(M)*LAMBDA(K)
      CALL GETIX
      PT(K) = PT(K)*PTR(J)
      K        = K+1
      M        = M+1
      IF(M.LE.MB) GO TO 522
      AREAO(1)=0.
      NK       = MB-MA+1
      LEND  = .FALSE.
      IF(DISP(2).NE.0. .OR. DISP(NK-2).NE.0.) LEND=.TRUE.
      CALL LSPFIT(S2(MA),RLAMDA,NK, S2(MA),AREAO,NK, -1)
      TAREA = AREAO(NK)

C     INTEGRATE CURVATURE WITH RESPECT TO S2
C     INITIAL ESTIMATE OF MERIDIONAL VELOCITY SQUARED
      SDNQRM(1)=0.
      CALL LSPFIT(S2(MA),CURV(MA),NK, S2(MA),SDNQRM,NK,-1)
      LEND  = .FALSE.
      M        = MA+1
      DO 525 K=2,NK
      VVKQKP(K-1)=EXP(2.*(SDNQRM(K)-SDNQRM(K-1))) * TT(K-1)/TT(K)
      SQRTVV(K-1)=SQRT(VVKQKP(K-1))
      VMSQ(K-1)=VM(M-1)*VM(M-1)
  525 M        = M+1
      VMSQ(NK)=VMB(L)*VMB(L)

      IF(MOMEQ.NE.0) GO TO 529
      VMSQ(NK)=VM(NK)*VM(NK)
      GO TO 650
  529 CONTINUE

C     SPECIFIED STATIC PRESSURE AND SPECIAL BOUNDARY OPTIONS - LOWER BDY
      VMLBSQ= 0.
      IF(NODENS.GE.NREFIN) GO TO 580
C      PRESSURE LOWER BOUNDARY
      IF(PLB.GT.0.) GO TO 530
      IF(TYPELB(L).NE.PRES) GO TO 532
```

```
530   IRET   = 0
      PSB    = PLB
      PTB    = PT(1)
      BDYNM  = NAMELB(L)
      ZBPT   = Z(MA)
      CFGT   = 1./(1.+FGR(1))
      C2CPTT= C2CP(1)*TT(1)
5306  IF(PSB.GT.0.) GO TO 5314
      IF(BDYNM.NE.IPRES(1)) GO TO 5310
      I1ZP   = 1
      I2ZP   = NZP
      IF(NZP1.NE.0) I2ZP=NZP1
      GO TO 5311
5310  I1ZP   = NZP1+1
      I2ZP   = NZP
5311  IF(ZBPT.GE.ZP(I1ZP).AND.ZP(I2ZP).GE.ZBPT) GO TO 5313
      IF(IRET.EQ.0) GO TO 5312
      TYPEUB(L)=SOLID
      GO TO 570
5312  TYPELB(L)=SOLID
      GO TO 540
5313  CALL LSPFIT(ZP(I1ZP),PSP(I1ZP),I2ZP-I1ZP+1, ZBPT,PSB,1, 0)
      IF(PSPISV) 5316,5314,5316
5314  IF(PSB.GE.PTB) GO TO 568
      VMBSQ = C2CPTT*(1.-(PSB/PTB)**CFGT)
      GO TO 5318
5316  VMBSQ = PSB*PSB
5318  IF(IRET.NE.0) GO TO 5414
      VMLBSQ= VMBSQ
      PLB    = PSB
      GO TO 540
C       FREE OR FIELD LOWER BOUNDARY
 532  IF(TYPELB(L).NE.FREE .AND. TYPELB(L).NE.FIELD) GO TO 534
      M       = MA
      CALL GETIX
      IF(MU.EQ.0) CALL ERROR1
      VMLBSQ= VM(MU)*VM(MU)
 533  PLB    = 1.E-6
      IF(TYPELB(L).NE.FIELD .OR. PASSI) GO TO 540
      VMUBSQ= 0.
      IF(TYPEUB(L).EQ.FIELD) GO TO 570
C       STREAMWISE INTERPOLATION OF VELOCITY AT ISTAG=3 POINT BY  LSPFIT
      IRET   = 1
5331  M4     = M
      CALL GETRLX
      II     = 0
      NII    = 3
      IF(M2.EQ.M4) GO TO 5333
      II     = 1
      NII    = 4
      S1B(II)=S1(M2)
      V1B(II)=VM(M2)
5333  S1B(II+1)=S1(M3)
      V1B(II+1)=VM(M3)
      S1B(II+2)=S1(M5)
      V1B(II+2)=VM(M5)
      S1B(II+3)=S1(M6)
      V1B(II+3)=VM(M6)
      IF(M6.EQ.M4) NII=NII-1
      CALL LSPFIT(S1B,V1B,NII, S1(M),VMM,1, 0)
      IF(IRET) 5335,5435,5335
```

```
 5335 VMLBSQ= VMM*VMM
      GO TO 540
C      FAR-FIELD LOWER BOUNDARY
  534 IF(TYPELB(L).NE.FARFLD) GO TO 540
      CALL ERROR1
*     CALL LSPFIT(ZDN,UDN,25, Z(MA),VMLBSQ,1, 0)
*     VMLBSQ= VMLBSQ*VMLBSQ
*     GO TO 533

C     UPPER BOUNDARY
  540 VMUBSQ= 0.
C      PRESSURE UPPER BOUNDARY
      IF(PUB.GT.0.) GO TO 541
      IF(TYPEUB(L).NE.PRES) GO TO 542
  541 IRET   = 1
      PSB    = PUB
      PTB    = PT(NK)
      BDYNM  = NAMEUB(L)
      ZBPT   = Z(MB)
      CFGT   = 1./(1.+FGR(NK))
      C2CPTT= C2CP(NK)*TT(NK)
      GO TO 5306
 5414 VMUBSQ=VMBSQ
      PUB    = PSB
      GO TO 570
C      FREE OR FIELD UPPER BOUNDARY
  542 IF(TYPEUB(L).NE.FREE  .AND. TYPEUB(L).NE.FIELD) GO TO 544
      M      = MB
      CALL GETIX
      IF(MU.EQ.0) CALL ERROR1
      VMUBSQ= VM(MU)*VM(MU)
  543 PUB    = 1.E-6
      IF(TYPEUB(L).NE.FIELD .OR. PASS1) GO TO 570
      IRET   = 0
      GO TO 5331
 5435 VMUBSQ= VMM*VMM
      GO TO 570
C      FAR-FIELD UPPER BOUNDARY
  544 IF(TYPEUB(L).NE.FARFLD) GO TO 570
      CALL LSPFIT(ZDN,UDN,25, Z(MB),VMUBSQ,1, 0)
      VMUBSQ= VMUBSQ*VMUBSQ
      GO TO 543
  568 WRITE (6,1568) Z(M),R(M),PSB,PTB
      CALL ERROR1

C     MAX FLOW CALC & PRES BOUNDARY CAN NOT BOTH BE REQUESTED
  570 IF((VMUBSQ+VMLBSQ).EQ.0.  .OR.  .NOT.CHOKE) GO TO 580
      WRITE (6,1570) X1(L),L,TYPELB(L),TYPEUB(L)
      CALL ERROR1

C     BEGIN FLOW BALANCE ITERATION
  580 QV(1) = 0.
      IF(VMUBSQ.NE.0.) VMSQ(NK)=VMUBSQ
      VMSQSV= VMSQ(NK)

C     NEGTS,VVSAFE ARE USED FOR SALVAGING NEGATIVE TEMPERATURE SITUATIONS
      NEGTS = 0
      VVSAFE= 0.
      GO TO 600
  590 NEGTS = NEGTS+1
      IF(NEGTS.GE.20 .OR. (PLB+PUB).NE.0.) CALL ERROR1
```

```
      VMSQ(NK)=.5*(VMSQ(NK)+VVSAFE)

C****STEP BY STEP INTEGRATION OF NORMAL MOMENTUM EQUATION
  600 VRATIO= VMSQ(NK)/VMSQSV
      K      = NK

C     PREDICT VELOCITY AT K
  610 K      = K-1
      IF(K) 615,650,615

C     COEFFICIENT VALUES AT K+1
  615 TS(K+1)=TT(K+1)-VMSQ(K+1)/C2CP(K+1)
      CDPT1 = RG(K+1)*TS(K+1)/PT(K+1)

C     COEFFICIENT VALUES AT K
      VMSQ(K)=VMSQ(K)*VRATIO
  620 VMSQK = VMSQ(K)
      TS(K) = TT(K)-VMSQ(K)/C2CP(K)
      CDPT  = CDPT1 + RG(K)*TS(K)/PT(K)

C     INTEGRATE
      IF(DISP(K).NE.0.) GO TO 625
  622 VMSQ(K)=VMSQ(K+1)*VVKQKP(K) + SQRTVV(K)*(CDPT*(PT(K)-PT(K+1)))
      GO TO 630
C     (WAKE DISCONTINUITY)
  625 IF(PT(K+1).EQ.PT(K)) GO TO 622
      PSLIP = PT(K+1)*(TS(K+1)/TT(K+1))*(TS(K+1)/TT(K+1))**FGR(K+1)
      IF(PSLIP.LT.PT(K)) GO TO 628
      M      = MA+K-1
      WRITE (6,1628) PT(K),PSLIP,Z(M),R(M),QV(1)
  628 TS(K) = TT(K)*(PSLIP/PT(K))/(PSLIP/PT(K))**(FGR(K)/(1.+FGR(K)))
      VMSQ(K)=C2CP(K)*(TT(K)-TS(K))
  630 VMSQ(K)=AMAX1(VMSQ(K),.0001)
      IF(ABS(VMSQ(K)/VMSQK-1.).GE.2.E-5) GO TO 620
      GO TO 610
C.....END INTEGRATION OF MOMENTUM EQUATION

C**  INTEGRATION OF FLOW AREA
  650 AREA(1)=AREAO(1)
      M      = MA
      DO 660 K=1,NK
      VM(M) = SQRT(VMSQ(K))
      IF(MOMEQ.NE.0) GO TO 654
      TS(K) = TT(K)-VMSQ(K)/C2CP(K)
      IF(TS(K).LT.0.) CALL ERROR1
  654 CONTINUE
      IF(TS(K).LT.0. .AND. FGR(K).NE.0.) GO TO 590
      RHO(K)= PT(K)/(RG(K)*TT(K)) * (TS(K)/TT(K))**FGR(K)
      WQA(K)= RHO(K)*VM(M)
      IF(M.EQ.MA) GO TO 660
C     NOTE - AVERAGE FLOW/AREA IS APPROXIMATELY SQRT(WQA(K-1)*WQA(K))
      WQAVG = WQA(K)+WQA(K-1)
      X      = (WQA(K)-WQA(K-1))*(WQA(K)-WQA(K-1))/(WQAVG*WQAVG)
      AREA(K)=AREA(K-1) + 2.*(WSTA(K)-WSTA(K-1)) /
     &                     (WQAVG*(1.-X*(.5+X*(.125+X*.0625))))
      IF(DISP(K-1).LE.0.) GO TO 660
      PERIM = .5*(LAMBDA(K-1)+LAMBDA(K))
  655 AREA(K)=AREA(K-1)+DISP(K-1)*PERIM
  660 M      = M+1
C...  END FLOW AREA INTEGRATION
```

```
C     RECIPROCAL OF CALCULATED FLOW AREA, ETC.
      IF(MOMEQ.EQ.0) GO TO 740
      QAREA = 1./AREA(NK)
      VMBC  = VM(MB)
      IF(PLB.LT.0. .OR. PUB.NE.0.) GO TO 740
      VMSQSV= VMSQ(NK)
      VVSAFE= VMSQSV
      IF(VMLBSQ.NE.0.) GO TO 710

C     CALL 'QIREM' FOR NEXT QUESS OF  VM(NK)=VMBC
      IF(QV(1).NE.0.) GO TO 680
      YO     = 1./TAREA
      YTOL   = 1.E-5*YO
      IF(WF.NE.0.) YO=YO*WF/WSTA(NK)
      DYDX   = DWDV(L)
      IF(DYDX.EQ.0. .OR. DYDX.EQ.XCHOKE) DYDX=YO/VMBC
      IF(.NOT.CHOKE) GO TO 675
      YO     = YO+YO
  675 QAREA1= QAREA
      VUB1   = VMBC
  680 XJP    = -.75*VMBC
      IF(.NOT.SUBSON) XJP=.25*VMBC
      CALL QIREM(VMBC,QAREA, XJP,QV)
      IF(QV(1).EQ.0.) GO TO 682
      IF(QV(5).EQ.0.) GO TO 684
      VMSQ(NK)=VMBC*VMBC
      GO TO 600

C     EVALUATE  D(W)/D(VLB),  SAVE VELOCITIES
  682 BOT    = VMBC-VUB1
      IF(ABS(BOT).GT.1.) DWDV(L)=(QAREA-QAREA1)/BOT
      GO TO 740

C     THE FLOW IS CHOKED
  684 IF(CHOKE) GO TO 740
      RATIO = QAREA*TAREA
      DO 686 K=1,NK
  686 AREA(K)=RATIO*AREA(K)
      CALL ADJWF2
      GO TO 740

C     CALL 'QIREM' FOR LOWER BOUNDARY PRESSURE ITERATION
  710 YO     = VMLBSQ
      YTOL   = 1.E-5*YO
      DYDX   = 1.
      CALL QIREM(VMSQ(NK),VMSQ(1),-.5*VMSQ(NK),QV)
      IF(QV(1).NE.0.) GO TO 600

C     CALCULATE BOUNDARY PRESSURE
  740 PLBC   = RHO(1)*RG(1)*TS(1)
      PUBC   = RHO(NK)*RG(NK)*TS(NK)
      WRQST = WSTA(NK)
      WCALC = WRQST*QAREA*TAREA
      IF(TYPELB(L).NE.TE) GO TO 745
      FGRTE(L)=FGR(1)
      RGTE(L)=RG(1)
      PTTE(L)=PT(1)
      PSTE(L)=PLBC
  745 IF(TYPEUB(L).NE.TE) GO TO 780
      FGRTE(L)=FGR(NK)
      RGTE(L)=RG(NK)
```

```
      PTTE(L)=PT(NK)
      PSTE(L)=PUBC

  780 IF(PDUM(9).LE.0.) GO TO 900
      IF(X1(L).GE.PDUM(8) .AND. X1(L).LE.PDUM(9)) GO TO 800
      GO TO 900
  800 CALL TABPRT(3HSTA,X1(L),LNEXT(L),5)
      CALL EDUMP1

C     RESET PLB AND PUB INDICATORS
  900 PLB    = 0.
      PUB    = 0.

C     COMPUTE SHOCK LOSS
      IF(PDUM(18).EQ.0.) RETURN
      K      = 1
      M      = MA
  910 SQM    = VMSQ(K)/(1.4*RG(K)*TS(K))
      IF(SQM.LE.1.) GO TO 920
      CALL GETIX
      IF(MD.EQ.0) GO TO 920
      VVMXSQ= VM(MD)*VM(MD)/(C2CP(K)*TT(K))
      SQMD   = 5.*VVMXSQ/(1.-VVMXSQ)
      IF(SQMD.GE.1.) GO TO 920
      DPTR   = 1. - ((6.*SQM)/(SQM+5.))**3.5 * (6./(7.*SQM-1.))**2.5
      PTR(J)= PTR(J) * (1.-PDUM(18)*DPTR)
  920 M      = M+1
      K      = K+1
      IF(M.LE.MB) GO TO 910
      RETURN
 1568 FORMAT(58H ***  ERROR IN FLOBAL. REQUESTED BOUNDARY PRESSURE EXCEE
     &DS/6X37HTOTAL PRESSURE AT TRAILING EDGE POINTF11.5,1H,F11.5,1H./
     &6X3HPS=F8.3,5X3HPT=F8.3,)
 1570 FORMAT(" ***  IN EVALUATING MAX FLOW AT STA="F6.3," (L="I4,
     &")  ROUTINE  FLOBAL  FINDS TYPE "A6,1H,A6," BOUNDARIES."/6X,
     &"VARY=F  MUST BE INPUT FOR CHANNELS ADJACENT TO FARFLD, FREE, OR P
     &RES BOUNDARIES.")
 1628 FORMAT(" ***  WARNING-JUST BELOW SLIP LINE, PT IS LESS THAN PS,  S
     &ETTING V=.01."/6X,3HPT=F8.3,6H    PS=F8.3,6H    Z=F8.3,5H    R=F8.3,
     &6H    QV=F3.0)
      END
```

```
*DECK LFIT2D
      SUBROUTINE LFIT2D(X,Y,TO,NXY)
*LFIT2D          LINEAR SURFACE INTERPOLATION                        *LFIT2D*
C                IN A RECTANGULAR GRID
      DIMENSION        X(2),Y(2),TO(2)

C     INPUT-
C      X,Y    = LIST OF COORDINATES AT WHICH INTERPOLATED VALUES ARE TO BE
C      NXY    = NO OF COORDINATE POINTS

C      NXT    = NUMBER OF XT
C      NYT    = NUMBER OF YT
C      XT     = X-GRID OF T-TABLE
C      YT     = Y-GRID OF T-TABLE
C      T      = TABLE OF VALUES
C      NOTE   = NUMBER OF T-VALUES IS NXT*NYT, ORDER IS ILLUSTRATED BELOW
C         YT(NYT)*  T(3)       T(6)       T(NXT*NYT)
C         YT(2)  *  T(2)       T(5)       T(8)
C         YT(1)  *  T(1)       T(4)       T(7)
C               --*----------------*-------------------
C                   XT(1)      XT(2)      XT(NXT)

C     OUTPUT-
C      TO     = INTERPOLATED VALUES AT X,Y

      COMMON /CTHICK/ NXT,NYT,XT(20),YT(20),T(78)
      COMMON /ERASE / DUM(400),T1(200),T2(200)

C      FIND CORRECT X-INTERVAL
      I      = 1
      M      = 1
      ISV    = 0
  100 NCOUNT= 0
  105 IF(X(M).LT.XT(I)) GO TO 110
      IF(X(M).GT.XT(I+1)) GO TO 120
      F      = (X(M)-XT(I))/(XT(I+1)-XT(I))
      GO TO 150
  110 IF(I.EQ.1) GO TO 140
      I      = I-1
      GO TO 125
  120 IF((I+1).GE.NXT) GO TO 145
      I      = I+1
  125 NCOUNT= NCOUNT+1
      IF(NCOUNT.GT.NXT) CALL ERROR1
      GO TO 105
  140 F      = 0.
      GO TO 150
  145 F      = 1.

C      INTERPOLATE WRT Y
  150 IF(I.EQ.ISV) GO TO 160
      IJ2    = I*NYT+1
      IJ1    = IJ2-NYT
      CALL LFIT1(YT,T(IJ1),NYT, Y,T1,NXY)
      CALL LFIT1(YT,T(IJ2),NYT, Y,T2,NXY)
      ISV    = I

C      INTERPOLATE WRT X
  160 TO(M) = F*T2(M)+(1.-F)*T1(M)

      M      = M+1
      IF(M.LE.NXY) GO TO 100
```

```
C,..  END LOOP FOR INTERPOLATIONG TO(M) AT X(M),Y(M),M=1,NXY

      RETURN
      END
```

```
*DECK TTPT
      SUBROUTINE TTPT(MA,MB, WSTA,DISP,WAKE,TT,PT,LAM,RGX,C2CPX,FGRX)
*TTPT--          TT, PT, AND RCU FOR STREAMLINES                  *TTPT*
       LOGICAL                             WAKE
       REAL                                                 LAM(25)
       DIMENSION WSTA(25),DISP(25),TT(25),PT(25),
     1              RGX(25),C2CPX(25),FGRX(25)


C     INPUT-
C      MA     = FIRST FIELD POINT
C      MB     = LAST FIELD POINT

C     OUTPUT-
C      WSTA   = LIST OF STREAM FUNCTION VALUES
C      DISP(K)=NON-ZERO FOR POSSIBLE SLIP CONDITION BETWEEN STREAMLINE
C               K AND K+1.  OTHERWISE DISP(K)=0.
C             = DISPLACEMENT THICKNESS OF WAKE IF POSITIVE
C      WAKE   = .TRUE. IF THERE EXISTS ANY WAKE DISPLACEMENTS.
C      TT     = INTERPOLATED TOTAL TEMPERATURE
C      PT     = INTERPOLATED TOTAL PRESSURE
C      LAMBDA= LAMINA THICKNESS IN THIRD DIMENSION.  BLOCKAGE EFFECT
C      RCU    = INTERPOLATED ANGULAR MOMENTUM          ***NOT NOW IN USE
C      RGX    = GAS CONSTANT
C      C2CPX = SPECIFIC HEAT
C      FGRX   = 1./(GAM-1.)= FUNCTION OF GAMMA FOR CALCULATING DENSITY
C      NOTE - LENGTH OF WSTA,TT,PT,RCU-LISTS IS MB-MA+1

C    WAKETB, CONVTB, CADJWF
C     TABLE OF CONVECTED PROPERTIES
C      INDEX- LT=LTO,LTE
      COMMON /CHDATA/ CH(1),LTNEXT(1),NPT(1),LPSI(1),LTT(1),LPT(1),
     1                LRCU(1),
     2                CRG(1),CPGJ(1),C2CP(1),GGAM(1),FGT(1),FGP(1),
     3                FGR(1),AREATB(485)
       INTEGER CH
      DIMENSION XCH(1)
      EQUIVALENCE (CH,XCH)
*   SEE OTHER LISTING OF TTPT FOR EXPLANATION OF VARIABLES
C     FLOW ADJUSTMENT TABLE
C      INDEX- LF=LFO,LFE
       DIMENSION        X1F(1),X2F(1),X1BF(1),X1AF(1),
     1                  S1F(1),NCHB(1),NCHA(1),JORDER(1),VNR(12)
       EQUIVALENCE      (LFB,X1BF),(LFA,X1AF),(LRF,NCHB),(LRXF,NCHA)
       DIMENSION        LFB(1),LFA(1),LRF(1),LRXF(1)
C     TABLE OF WAKE DISPLACEMENT THICKNESS
C      INDEX- LW=LWO,LWE
       DIMENSION               X2W(1),LWNEXT(1),S1W(47)
       DIMENSION        DST(1)
       EQUIVALENCE      (DST,S1W)
C      SUBTABLE ARRANGEMENT IS-
C       X2W,LWNEXT(=2+2N), S1W(1),S1W(2)...S1W(N), DST(1),DST(2)...DST(N)
C      X2W    = STREAMLINE COORDINATE
C      S1W    = DISTANCE ALONG STREAMLINE FROM T.E.
C      DST    = WAKE DISPLACEMENT THICKNESS AS A FUNCTION OF S1W
       EQUIVALENCE      (CH,X1F,X2W), (LTNEXT,X2F,LWNEXT), (NPT,X1BF,S1W)
       EQUIVALENCE      (LPSI,X1AF), (LTT,S1F), (LPT,NCHB), (LRCU,NCHA)
       EQUIVALENCE      (CRG,JORDER), (CPGJ,VNR)

      COMMON /SLTAB / W(128),X2(128),SLCHN(128)
       INTEGER SLCHN
      COMMON /IXORIG/ LHO,LHE, LBDO,LBDE, LTO,LTE, LWO,LWE, LFO,LFE,
```

```
     *                  LO,LESTA,  LDUM(8),
     *                  MO,NM, NJ,NFCOLS, MAXNJ,MAXOL,MAXNM,MAXLE,
     *                  LEO,LEE, LRO,LRE,LRD
      DIMENSION         LIMITS(24)
      EQUIVALENCE       (LIMITS,LHO)

      COMMON /CIDEX / M,J,MU,MD,ISTAG
      COMMON /CMAXIT/ MAXIT,MAJCTR,GREFIN,EDUM
      COMMON /CPTMOV/ VELPOT,ICOB,NODENS,CPTDUM
      COMMON /CR    / R(300)
      COMMON /CS1   / S1(300)
      COMMON /CTHICK/ NTHKX,NTHKY,THKX(20),THKY(20),THIK2D(78)
      COMMON /CZ    / Z(300)
      COMMON /ERASE / PSI(800)

      INTEGER          CHX

C     INTERPOLATE FOR LAMINA THICKNESS
      NK     = MB-MA+1
      CALL SETM(1,1., LAM,NK)
      IF(NTHKX.LE.1) GO TO 100
      CALL LFIT2D(Z(MA),R(MA),LAM,NK)

C     INITIALIZE
  100 WAKE   = .FALSE.

C     DEFINE NUMBER OF STREAMLINES,  NK,  ASSOCIATED WITH EACH CHANNEL
      K      = 1
      M      = MA
      WADD   = 0.
  105 NK     = 0
      K1     = K
      M1     = M
  110 CALL GETIX
      IF(M.NE.M1) GO TO 114
      CHX    = SLCHN(J)
      PSI1   = X2(J)
  114 IF(SLCHN(J).NE.CHX) GO TO 120
      NK     = NK+1
      DISP(K)=0.
      WSTA(K)=W(J)+WADD
      PSI(NK)=X2(J)
      K      = K+1
      M      = M+1
      IF(M.LE.MB) GO TO 110

C     FIND INDEX IN CONVTB
  120 LT     = LTO
  125 IF(LT.GT.LTE) CALL ERROR1
      IF(CH(LT).EQ.CHX) GO TO 130
      LT     = LT+LTNEXT(LT)
      GO TO 125

C     INTERPOLATE FOR CONVECTED PROPERTIES
C     SCALE THE PSI TABLE TO CONFORM TO THE LPSI-TABLE IN /CONVTB/
  130 NI     = NPT(LT)
      I      = LT+LPSI(LT)
      I2     = I+NI
      IF(K1.EQ.1 .AND. NK.EQ.1) PSI1=PSI1*8.
      PSI1   = 8.*AINT(PSI1/8.)
      F      = XCH(I2-1)/8.
```

```
      DO 140 KN=1,NK
  140 PSI(KN)=(PSI(KN)-PSI1)*F
      IT    = LT+LTT(LT)
      IP    = LT+LPT(LT)
      IS    = LT+LRCU(LT)
      CALL LSPFIT(CH(I),CH(IT),NI, PSI,TT(K1),NK, 0)
      CALL LSPFIT(CH(I),CH(IP),NI, PSI,PT(K1),NK, 0)
C     CALL LSPFIT(CH(I),CH(IS),NI, PSI,RCU(K1),NK, 0)
      CALL SETM(1,CRG(LT),RGX(K1),NK)
      CALL SETM(1,C2CP(LT),C2CPX(K1),NK)
      CALL SETM(1,FGR(LT),FGRX(K1),NK)

C    WAKE DISPLACEMENT THICKNESS
C     SEARCH FOR X2-SUBTABLE
      IF(M.GT.MB) GO TO 200
      X2J   = X2(J)
      DISP(K-1)=-1.
      LW    = LWO
  155 IF(LW.GE.LWE) GO TO 190
      IF(X2W(LW).EQ.X2J) GO TO 170
      LW    = LW+LWNEXT(LW)
      GO TO 155
C     FIND TRAILING EDGE S1 IN THE FLOW ADJUSTMENT TABLE, S1F
  170 LF    = LFO
  175 IF(X2F(LF).EQ.X2J) GO TO 180
      LF    = LF+NFCOLS
      IF(LF.LT.LFE) GO TO 175
      CALL ERROR1
C     INTERPOLATE FOR WAKE DISPLACEMENT THICKNESS, DSTAR
  180 S1FTE=S1(M)-S1F(LF)
C      S1-FROM-T.E.
      IF(S1FTE.LE.0.) GO TO 190
      N     = (LWNEXT(LW)-2)/2
      LSTAR = LW+N
      CALL LSPFIT(S1W(LW),DST(LSTAR),N, S1FTE,DISP(K-1),1, 0)
      IF(DISP(K-1)) 184,184,186
  184 DISP(K-1)=-1.
      GO TO 190
  186 WAKE  = .TRUE.

C    LOOP FOR NEXT CHANNEL
  190 WADD  = WSTA(K-1)
      GO TO 105

C    USE CONSTANT DENSITY APPROXIMATION FOR  MAJCTR.LE.NODENS
  200 IF(MAJCTR.LE.NODENS) CALL SETM(1,0.,FGRX,K-1)
      RETURN
      END
```

```
      OVERLAY(STC,2,1)
      PROGRAM STCX
      COMMON /ADJWF1/  MODE,LFF,MODE0,LFO
      COMMON /SELECT/  LENTRY
      GO TO (10,20,30,20),LENTRY
   10 CALL ADJWF(MODE0,LFO)
   20 CALL STALOO
      GO TO 40
   30 CALL ADJWF(MODE,LFF)
   40 RETURN
      END
```

```
*DECK ADJWF
      SUBROUTINE ADJWF(MODE,LFF)
*ADJWF*         ADJUST WEIGHT FLOW                                   *ADJWF*

C     INPUT-
C      MODE   = OPERATION MODE
C             = -1 FOR EVALUATION OF TERWF AT LFF
C             = 0 FOR ADJUSTMENT OF FLOW RATES AT CHOKED STATIONS
C             = 1 FOR ADJUSTMENT OF FLOWS FOR KUTTA CONDITION AT T.E. LFF
C      LFF    = FLOW ADJUSTMENT TABLE (T.E.) INDEX
C      TOLWFU= TOLERANCE ON TERWF

C     OUTPUT-
C       MODE   = 1 IF FLOW RATE HAS BEEN CHANGED FOR TE=LFF
C       MODE   = 2 IF TE=LFF HAS CONVERGED AND LFF HAS BEEN INDEXED
C       MODE   = 3 IF ALL TE S HAVE CONVERGED
C        NOTE-ABOVE OUTPUT OCCURS FOR MODE=1 INPUT
C      TEXI2 = T.E. XI2-COORDINATE
C      TWF    = FLOW RATE OF VARIABLE CHANNEL
C      TERWF = KUTTA CONDITION INDICATED FRACTIONAL FLOW ERROR

C   COMB3
C    CADJWF, CHDATA, STATAB
      COMMON /CHDATA/ CHNAM(1),LHNEXT(1),WTFLOW(1),TTO(1),PTO(1),
     *                TSO(1),PSO(1),MACHO(1),AO(1),VARY(5),TAB(6)
       INTEGER        CHNAM
       LOGICAL                                  VARY
C     FLOW ADJUSTMENT TABLE
C      INDEX- LF=LFO,LFE
C      NFCOLS= 8
C      X1F    = ORTHOGONAL COORDINATE
C      X2F    = STREAMLINE COORDINATE OF SL EMINATING FROM T.E.
C      X1BF   = X1-COORDINATE OF CHOKE STATION OF FLOW BELOW T.E.
C      X1AF   = X1-COORDINATE OF CHOKE STATION OF FLOW ABOVE T.E.
C      S1F    = S1-COORDINATE OF T.E. (UPPER SURFACE). THIS ITEM
C               IS USED WHEN INTERPOLATING FOR WAKE DELTA-STAR.
C      LFB,LFA=INDICES OF STATIONS BELOW AND ABOVE T.E.
C      NCHB,NCHA=NUMBER OF CHANNELS BELOW AND ABOVE T.E.
C      LRF    = INDEX OF DUMMY ORTCHN LIST FOR THE T.E.
C      LRXF   = INDEX OF LAST CHANNEL BELOW THE T.E.
C      JORDER= 0 IF TOTAL FLOW AT X1F IS GIVEN
C            = 2 IF FLOW ABOVE T.E. IS GIVEN
C            = 1 IF FLOW BELOW T.E. IS GIVEN
C      JORDER= -1 IF FLOW AT X1F IS CHOKED AND SINGLE CHANNEL
       DIMENSION        X1F(1),X2F(1),X1BF(1),X1AF(1),
     1                  S1F(1),NCHB(1),NCHA(1),JORDER(1),VNR(12)
       EQUIVALENCE      (LFB,X1BF),(LFA,X1AF),(LRF,NCHB),(LRXF,NCHA)
       DIMENSION        LFB(1),LFA(1),LRF(1),LRXF(1)
C     STATION TABLE
C      INDEX- L=LO,LESTA
C      SCHOKE= STATION CHOKE INDICATOR (ADJWF,BRWS,WRIOUT)
C      MCL    = SHARP CORNER INDICATOR (BLDTBS)
C      MCL    = FIELD INDEX OF CONTROL STREAMLINE (PTMOVE,FLOBAL)
       DIMENSION        X1(1),LNEXT(1),MLB(1),MUB(1),PRIM(1),
     1                  TYPELB(1),NAMELB(1),ILB(1),FLB(1),S1LB(1),
     1                  TYPEUB(1),NAMEUB(1),IUB(1),FUB(1),S1UB(1),
     &                  VMB(1),DWDV(1),X2CL(1),BLSWT(1),MCL(1),
     &                  ANGTE(1),PTTE(1),PSTE(1),FGRTE(1),RGTE(1),
     &                  ANGEXP(1),BSQEXP(475)
        DIMENSION       CRVLE(1),ANGLE(1)
        EQUIVALENCE     (SCHOKE,DWDV),(CRVLE,ANGTE),(ANGLE,PTTE)
        INTEGER         PRIM,TYPELB,TYPEUB,SCHOKE(1)
```

```
      EQUIVALENCE   (CHNAM,X1F,X1), (LHNEXT,X2F,LNEXT)
      EQUIVALENCE   (WTFLOW,X1BF,MLB), (TTO,X1AF,MUB), (PTO,S1F,PRIM)
      EQUIVALENCE   (TSO,NCHB,TYPELB), (PSO,NGHA,NAMELB)
      EQUIVALENCE   (MACHO,JORDER,ILB), (AO,VNR,FLB), (VARY(1),S1LB)
      EQUIVALENCE   (VARY(2),TYPEUB), (VARY(3),NAMEUB), (VARY(4),IUB)
      EQUIVALENCE   (VARY(5),FUB)
       EQUIVALENCE   (TAB(1),AREATB,S1UB), (TAB(2),VMB), (TAB(3),DWDV)
       EQUIVALENCE   (TAB(4),X2CL),(TAB(5),SLSWI),(TAB(6),MCL)
C
      COMMON /ALLCOM/ MACHA,PSA,TSA,PTA,TTA, AXIA,RGA,GAMA,
     1                MACHC,PSC,TSC,PTC,TTC, AXIC,RGC,GAMC,
     2                DAXIT,SCALEA,TTE,CHOTST
       REAL           MACHA(1),MACHC
       LOGICAL        AXIA,AXIC,CHOTST
      COMMON /CFB   / L,MA,MB,PLB,PUB,WF,CHOKE,SUBSON, NK,PLBC,PUBC,
     1                XCHOKE, TAREA,VMBC, WROST,WCALC, QV(8),QVP(8),
     *                JSUM,VMLBSQ
       LOGICAL                               CHOKE,SUBSON
       INTEGER         XCHOKE
      COMMON /CSS   / SSFML,SSEF,SSEANG,SSDF,SSFEND,SSFND1
     1               ,SSDLE,A4FACT,BRLX,CURRLX,TSIC
       INTEGER        SSFML
       LOGICAL              SSEF,      SSDF,    SSDLE
      COMMON /ERASE2/ AREA(96),AREAO(96),DISP(96),PT(96),LAMBDA(96),
     1                RHO(96),SQRTVV(96),TS(96),TT(96),VMSQ(96),
     2                VVKQKP(96),
     2                WOA(96),WSTA(96), RG(96),C2CP(96),FGR(96)
       REAL           LAMBDA
       DIMENSION      ES2(96),SDNORM(96)
       EQUIVALENCE    (ES2,VVKQKP),(SDNORM,RHO)
       DIMENSION      RCU(96)
       EQUIVALENCE    (RCU,LAMBDA)
C     INDEX- M=MO,NM
      COMMON /CZ    / Z(300)
      COMMON /CR    / R(300)
      COMMON /CS2   / S2(300)
      COMMON /CS1   / S1(300)
      COMMON /CPHI1 / PHI1(300)
      COMMON /CM    / JMS(300)
      COMMON /CCURV / CURV(300)

      COMMON /CB    / B(300)
      COMMON /CIDEX / M,J,MU,MD,ISTAG
      COMMON /IXORIG/ LHO,LHE, LBDO,LBDE, LTO,LTE, LWO,LWE, LFO,LFE,
     *                LO,LESTA,  LDUM(8),
     *                MO,NM, NJ,NFCOLS, MAXNJ,MAXOL,MAXNM,MAXLE,
     *                LEO,LEE, LRO,LRE,LRD
       DIMENSION      LIMITS(24)
       EQUIVALENCE    (LIMITS,LHO)
      COMMON /SLTAB / W(128),X2(128),SLCHN(128)
       INTEGER SLCHN
      COMMON / CTE  / TOLWF,TOLWFU,TEXI2,TWF,TERWF,JRET
      COMMON /CINNER/ INRCTR,RDUM,NINNER(16),CNVF(16)
      COMMON /CPRINT/ CDUM(6),PDUM(20)
      COMMON /CQIREM/ YTOL,YO,DYDX,CTRMAX
      COMMON /CTABRR/ I1TAB
      COMMON / CGRAV / CG

      NAMELIST /ADJ1/ PSTE,WB,WCALC,WAB,YO
C     BEGIN LOOP THROUGH FLOW ADJUSTMENT TABLE
      IF (LFF.EQ. 0) LFF=LFO
```

```
      LF     = LFF
      IF(LF.GE.LFE) GO TO 390
  100 IF(JORDER(LF).EQ.3) GO TO 310
C     MODE=1, THIS ENTRY FOLLOWS A MODE=-1, CONTINUE THE CALCULATION BY
C       JUMPING TO THE PREVIOUS EXIT POINT.
      IF (MODE.EQ.1 .AND. LF.EQ.LFF) GO TO (138,251),JRET
      PLB    = 0.
      PUB    = 0.
      WF     = 0.
      CHOKE  = .FALSE.
      SUBSON= .TRUE.
      X1TE   = X1F(LF)
      X2TE   = X2F(LF)
      LXA    = 1
      LKB    = 0
      IF(JORDER(LF).LT.0) GO TO 118

C     SEARCH FOR THE TWO STATIONS AT X1F(LF)
      CALL STAX1(X1TE,X2TE,X2TE,LXB,LXA)

C     SEARCH FOR CHOKE STATION IF THE FLOW IS CHOKED UPSTREAM
      LKB    = LXB
      LKA    = LXA
      IF(X1BF(LF).NE.X1TE) CALL STAX1(X1BF(LF),X2TE,-1.,LKB,DUM)
      IF(X1AF(LF).EQ.X1TE) GO TO 120
  118                       CALL STAX1(X1AF(LF),-1.,X2TE,DUM,LKA)
  120 IF(MODE) 122,130,122
  122 IF(JORDER(LF)) 300,140,200

C     SINGLE CHANNEL CHOKE
  130 IF(JORDER(LF).EQ.(-1)) GO TO 133
      IF (LKB.NE.LXB) GO TO 132
  131 IF(LKA.NE.LXA) GO TO 133
      GO TO 136
  132 L      = LKB
      GO TO 134
  133 L      = LKA
  134 CHOKE  = .TRUE.
      CALL FLOBAL
      SCHOKE(L)=XCHOKE
      LK2    = L
      VMB(L)= VMBC
      RATIO  = WCALC/WRQST
      ASSIGN 135 TO IRET
      TEX12  = X2TE
      IF (LKB.EQ.0 .OR. L.EQ.LKB) TWF = WCALC*CG
      GO TO 255
  135 IF(L.EQ.LKB) GO TO 131
  136 LF     = LF+NFCOLS
      IF(LF.LT.LFE) GO TO 100
      GO TO 900

C**  ITERATE FOR T.E. PRESSURE, JORDER(LF)=0
  140 PTEMIN = -1.E6
      PSTE   = PTEMIN
      IF(.NOT.CHOTST) GO TO 150
      L      = LKB
      CHOKE  = .TRUE.
      CALL FLOBAL
      PUBX   = PUBC
      WBCHOK= WCALC
```

```
      WBO    = WRQST
      L      = LKA
      CALL FLOBAL
      PLBX   = PLBC
      WACHOK= WCALC
      CHOKE = .FALSE.
C      T.E. STATION PRESSURE
      IF(LKB.EQ.LXB) GO TO 142
      L      = LXB
      WF     = WBCHOK
      CALL FLOBAL
      PUBX   = PUBC
  142 IF(LKA.EQ.LXA) GO TO 144
      L      = LXA
      WF     = WACHOK
      CALL FLOBAL
      PLBX   = PLBC
  144 WF     = 0.
      SUBSON = .TRUE.
      PTEMIN = AMIN1(PUBX,PLBX)
      PSTE   = PTEMIN
      IF (SSDF .AND. LKB .NE. LXB .AND. LKA .NE. LXA ) GO TO 1576


  150 QVP(1)= 0.
  155 L      = LXB
      PLB    = 0.
      PUB    = PSTE
      CALL FLOBAL
      VMBSAV= VMBC
      PTB    = PT(NK)
      WBO    = WRQST
      WB     = WCALC

      L      = LXA
      IF(QVP(1).EQ.0.) PSTE=PUBC
      PLB    = PSTE
      PUB    = 0.
      CALL FLOBAL
      YO     = WBO+WRQST
      IF(.NOT.CHOTST) GO TO 157
      IF(PSTE.LT.PUBX) WB=WBCHOK
      IF(PSTE.LT.PLBX) WCALC=WACHOK
  157 WAB    = WB+WCALC
      YTOL   = 1.E-5*YO
      DYDX   = -1.E-5

      IF(PDUM(6).EQ.2.)WRITE(6,ADJ1)
      CALL QIREM (PSTE,WAB,.5*(AMIN1(PT(1),PTB)-PSTE),QVP)
      IF (PSTE .GE. PTEMIN) GO TO 1574
      WBP     = CG*WBCHOK
      WAP     = CG*WACHOK
      LFPR   = LF + 3
      WRITE (6,1157) (X1F(I),I=LF,LFPR),PTEMIN,WBP,WAP
      GO TO 1576
 1574 IF(QVP(1).NE.0.) GO TO 155
      VMB(LXB)=VMBSAV
      VMB(LXA)=VMBC

C     INDICATED FLOW ADJUSTMENT ERROR
      YY     = (WB-WBO)/YO
```

```
      XX     = WBO/YO
      GO TO 1578
C       T.E. OF 2 CD-NOZZLES OR BOTH CHNS CHOKED
 1576 YY     = BITS
      XX     = 1.
 1578 TEXI2 = X2F(LF)
      TWF    = WBO*CG
      TERWF  = YY
      JRET   = 1
      IF(MODE.EQ.(-1)) RETURN
  158 IF(XX .EQ. 1.) GO TO 1585
      IF(ABS(YY).LT.TOLWFU) GO TO 300
*     MARK STATION TABLE CHOKE INDICATOR
 1585 IF(.NOT.CHOTST) GO TO 159
      IF(PSTE.LE.PUBX) SCHOKE(LKB)=XCHOKE
      IF(PSTE.LE.PLBX) SCHOKE(LKA)=XCHOKE

C     OBTAIN NEXT FLOW ITERATE
  159 IF (XX .EQ. 1. ) GO TO 165
      IF(VNR(LF).NE.0.) GO TO 160
      VNR(LF+1)=-2.
      VNR(LF+2)=.1
  160 XXNEW = XX
      VNR(LF+6)=0.
      CALL NEWRAP(XXNEW,YY,VNR(LF))
      IF(VNR(LF+6).EQ.(-1.)) XXNEW=XX
      RATIO = XXNEW/XX
      GO TO 166
  165 RATIO = WBCHOK/WBO
  166 ASSIGN 170 TO IRET
      L      = LXB
      GO TO 255
  170 RATIO = (1.-XXNEW)*YO/WRQST
      ASSIGN 900 TO IRET
      L      = LXA
      IF (XX .NE. 1.) GO TO 255
      RATIO = WACHOK/WRQST
      ASSIGN 300 TO IRET
      GO TO 255

C**  CALCULATION OF TE PRESSURE (GIVEN FLOW) AT STATION LX1,
C**                        JORDER(LF)=1,2
  200 IF(JORDER(LF).EQ.2) GO TO 205
C      JORDER=1
      LX1    = LXB
      LX2    = LXA
      LK1    = LKB
      LK2    = LKA
      GO TO 210
C      JORDER=2
  205 LX1    = LXA
      LX2    = LXB
      LK1    = LKA
      LK2    = LKB
  210 L      = LX1
      CALL FLOBAL
      VMB(L)= VMBC
      IF(JORDER(LF).EQ.2) GO TO 220
      PLBX   = PUBC
      PUBX   = 0.
      GO TO 230
```

```
  220 PLBX   = 0.
      PUBX   = PLBC

C    CALCULATION OF FLOW (GIVEN TE PRESSURE) AT STATION LX2
  230 IF(.NOT.CHOTST) GO TO 245
C     CALCULATE MAXIMUM/CHOKED FLOW
      L      = LK2
      CHOKE = .TRUE.
      CALL FLOBAL
      CHOKE = .FALSE.
      VMBSAV= VMBC
      WACHOK= WCALC
      RATIO = WCALC/WRQST

C    CALCULATE PRESSURE AT THE T.E. STATION
 235  L      = LX2
      IF(LK2.EQ.LX2 .OR. SSDF) GO TO 240
      WF     = WCALC
      CALL FLOBAL
      WF     = 0.
  240 IF((PLBX.NE.0. .AND. PLBC.GE.PLBX) .OR.
     *   (PUBX.NE.0. .AND. PUBC.GE.PUBX)) GO TO 242
      GO TO 245

C     CHOKED FLOW
  242 SCHOKE(LK2)=XCHOKE
      VMB(LK2)=VMBSAV
      GO TO 2505

C     FLOW IS NOT CHOKED
  245 PLB    = PLBX
      PUB    = PUBX
      CALL FLOBAL
  250 VMB(L)= VMBC

C     INDICATED FLOW ADJUSTMENT ERROR
      TERWF = (WCALC-WRQST)/WRQST
 2505 TEXI2 = X2F(LF)
      TWF    = WRQST*CG
      JRET   = 2
      IF(MODE.EQ.(-1)) RETURN
  251 ASSIGN 300 TO IRET
      IF(SCHOKE(LK2).EQ.XCHOKE) GO TO 255
      IF(ABS(TERWF).LT.TOLWFU) GO TO 300

C     OBTAIN NEXT FLOW ITERATE
      IF(VNR(LF).NE.0.) GO TO 252
      VNR(LF+1)=-2.
      VNR(LF+2)=.25*WRQST
  252 WNEW   = WRQST
      VNR(LF+6)=0.
      CALL NEWRAP(WNEW,WCALC-WRQST,VNR(LF))
      IF(VNR(LF+6).EQ.(-1.)) WNEW=WCALC
      IF(.NOT.CHOTST .OR. WACHOK.GE.WNEW) GO TO 253
      WNEW   = WACHOK
      SCHOKE(LK2)=XCHOKE
      GO TO 254
  253 IF(SCHOKE(LK2).EQ.XCHOKE) DWDV(LK2)=0.
      LK2    = LX2
      ASSIGN 900 TO IRET
  254 RATIO = WNEW/WRQST
```

```
C     ADJUST FLOW IN THE STREAMLINE TABLE
  255 M       = MLB(L)
      CALL GETIX
      JA      = J
      M       = MUB(L)
      CALL GETIX
      JB      = J
C      CHECK TO SEE IF USER WISHES FLOW RATE TO BE VARIED
      JX      = JA
  258 LH      = LHO
  260 IF(LH.GE.LHE) GO TO 267
      IF(CHNAM(LH).EQ.SLCHN(JX)) GO TO 265
      LH      = LH+LHNEXT(LH)
      GO TO 260
  265 IF(.NOT.VARY(LH)) GO TO 280
  267 IF(JX.EQ.JB) GO TO 270
      JX      = JB
      GO TO 258
C      ADJUST FLOWS
  270 DO 275 J=JA,JB
  275 W(J)    = W(J)*RATIO
      GO TO 290
C      DO NOT ADJUST FLOWS, PRINT COMMENT IF SUPER-CHOKED
  280 IF(SCHOKE(LK2).NE.XCHOKE) GO TO 290
      IF(RATIO.LT.1.) GO TO 282
      SCHOKE(LK2)=0.
      GO TO 290
  282 WRITE (6,1280) RATIO,X1(LK2),CHNAM(LH)
  290 GO TO IRET,(135,170,900,300)


C     INDEX TO NEXT TRAILING EDGE, MODE=1 AND TOLWF SATISFIED
  300 IF(LF.NE.LFF) WRITE(6,1300) TEXI2,TWF,TBRWF
      MODE    = 2
  310 LF      = LF+NFCOLS
      IF(LF.GE.LFE) LF=LFO
      IF(LF.NE.LFF) GO TO 100
C      ALL FLOW ADJUSTMENTS ARE CONVERGED
  390 MODE    = 3

C     RETURN
  900 LFF     = LF
      IF(PDUM(6).EQ.0.) RETURN
      I1TAB = LFO
      CALL TABPRT(6HCADJWF,X1F,LFE,10)
      CALL TABPRT(1HW,W,NJ,10)
      RETURN

 1157 FORMAT (53H ***  WARNING- BOTH CHNS CHOKED - XI1,XI2,XI1B,XI1A =,
     * 4F8.3,12H  PS,WB,WA =,3F10.4)
 1280 FORMAT(50H ***  CHOKING,  WILL NOT REDUCE FLOW SINCE VARY=F,6X,8
     *HRATIO = F9.6,9H    STA = F8.3,9H    CHN = A6)
 1300 FORMAT(99X,F6.0,F13.4,F11.4)
      END
```

```
*DECK BRHS
      SUBROUTINE BRHS
*BRHS--*         COEFFICIENT B AND RHS TERMS                          *BRHS*

C     OUTPUT-
C      RHS(M)= RIGHT HAND SIDE OF THE MATRIX EQUATION FOR  DS2
C      B(M)  = COEFFICIENT OF THE CURVATURE TERM

C     STATION TABLE
C      INDEX- L=LO,LESTA
C      SCHOKE= STATION CHOKE INDICATOR (ADJWF,BRHS,WRIOUT)
C      MCL    = SHARP CORNER INDICATOR (BLDTBS)
C      MCL    = FIELD INDEX OF CONTROL STREAMLINE (PTMOVE,FLOBAL)
       COMMON /CHDATA/ X1(1),LNEXT(1),MLB(1),MUB(1),PRIM(1),
     1                 TYPELB(1),NAMELB(1),ILB(1),FLB(1),S1LB(1),
     1                 TYPEUB(1),NAMEUB(1),IUB(1),FUB(1),S1UB(1),
     &                 VMB(1),DWDV(1),X2CL(1),SLSWT(1),MCL(1),
     &                 ANGTE(1),PTTE(1),PSTE(1),FGRTE(1),RGTE(1),
     &                 ANGEXP(1),BSQEXP(475)
         DIMENSION     CRVLE(1),ANGLE(1)
         EQUIVALENCE   (SCHOKE,DWDV),(CRVLE,ANGTE),(ANGLE,PTTE)
         INTEGER       PRIM,TYPELB,TYPEUB,SCHOKE(1)
       COMMON /ALLCOM/ MACHA,PSA,TSA,PTA,TTA, AXIA,RGA,GAMA,
     &                 MACHC,PSC,TSC,PTC,TTC, AXIC,RGC,GAMC,
     &                 DAXIT,SCALEA,TTE,CHOTST
        LOGICAL        AXIA,AXIC,CHOTST
        REAL           MACHA(1),MACHC
       COMMON /CB     / B(300)
       COMMON /BITS   / BITS,BLANK
       COMMON /CCURV  / CURV(300)
       COMMON /CDS2   / DS2(300)
       COMMON /CEDUMP/ IGODMP
       COMMON /CFB    / L,MA,MB,PLB,PUB,WF,CHOKB,SUBSON, NK,PLBC,PUBC,
     &                 XCHOKE, TAREA,VMBC, WRQST,WCALC, QV(8),QVP(8),
     &                 JSUM,VMLBSQ
        INTEGER        XCHOKE    ,
        LOGICAL                                 CHOKB,SUBSON
       COMMON /CIDEX  / M,J,MU,MD,ISTAG
       COMMON /CMAX4  / ES2MAX,ZMX,RMX,DS2MAX,LGNT
       COMMON /CMAXIT/ MAXREF,NREFIN
       COMMON /CPHI1  / PHI1(300)
       COMMON /CPI    / PI,TWOPI,PIO2,PIO4,TODEG,TORAD
       COMMON /CPRINT/ PDD(6),PDUM(10)
        EQUIVALENCE    (PRTES2,PDD)
       COMMON /CPTMOV/ DPTMOV(2),NODENS
       COMMON /CRHS   / RHS(300)
       COMMON /CR     / R(300)
       COMMON /CS1    / S1(300)
       COMMON /CS2    / S2(300)
       COMMON /CSS    / SSFML,SSEF,SSEANG,SSDF,SSFEND,SSFND1,
     &                 DSS(4),TSIC,RHOC,RHOCSS
        INTEGER        SSFML
        LOGICAL              SSEF,        SSDF
       COMMON /CTABPR/ I1TAB
       COMMON /CTOLRL/ TOLRL,MAXSWP,CLEN,DTOLR1,TOLES2,NSWP,
     &                 DS1DMP,DS1DP1,DTOLR2(4),SG1REF,TOLINR
       COMMON /CVM    / VM(300)
       COMMON /CZ     / Z(300)
       COMMON /ERASE2/ AREA(96),AREAO(96),DISP(96),PT(96),LAMBDA(96),
     &                 RHO(96),SQRTVV(96),TS(96),TT(96),VMSQ(96),
     &                 VVKQKP(96),
     &                 WOA(96),WSTA(96), RG(96),C2CP(96),FGR(96)
```

```
      REAL                LAMBDA
      DIMENSION           ES2(96),SDNORM(96)
      EQUIVALENCE         (ES2,VVKQKP),(SDNORM,RHO)
      COMMON /IXORIG/ LHO,LHE, LBDO,LBDE, LTO,LTE, LWO,LWE, LFO,LFE,
     &                    LO,LESTA,LSO,LSE,LDUM(6),
     &                    MO,NM, NJ,NFCOLS, MAXNJ,MAXOL,MAXNM,MAXLE,
     &                    LEO,LEE, LRO,LRE,LRD
      COMMON /SLTAB /     W(128),X2(128),SLCHN(128)
      INTEGER             SLCHN
      DIMENSION           ES2X1(96),ES2X2(96)
      DIMENSION           ES2SV(96), RMXSV(96), ZMXSV(96)
      INTEGER             FARFLD,FIELD,FREE,PRES,SOLID,TE
      LOGICAL             ENTRY2,  SSOL
C     SSOL   = SUPERSONIC POINT ON THIS OL, T OR F

      DATA FARFLD/6HFARFLD/, FIELD/5HFIELD/, FREE/4HFREE/,
     &     PRES/4HPRES/, SOLID/5HSOLID/, TE/2HTE/

C     INITIALIZE
      BDUMMY= 1./1024.

C     SUBSONIC/SUPERSONIC BRANCH SELECTION
      M      = MLB(L)
      CALL GETIX
      JA     = J
      MAA    = M
      M      = MUB(L)
      CALL GETIX
      JB     = J
      MBB    = M
      IF(JSUM.EQ.0) SUBSON=.TRUE.
      IF(SSEF) SUBSON=.FALSE.
      IF(SCHOKE(L).NE.XCHOKE) GO TO 500
      IF(SSDF) SUBSON=.FALSE.
      JSUM   = JA+256*JB

C     EXECUTE FLOW BALANCE
  500 CALL FLOBAL
      IF(TYPELB(L).EQ.TE .OR. TYPEUB(L).EQ.TE) JSUM=0
      IF( MA.EQ.MB ) CALL ERROR1
C I THINK THE ABOVE STATEMENT CAN BE REMOVEED - 1 14 75
      VMB(L)= VMBC

C     EVALUATE S2-DEVIATIONS
      F      = 1.
      IF((TYPELB(L).EQ.SOLID .AND. TYPEUB(L).EQ.SOLID) .OR.
     & TYPELB(L).EQ.FIELD .OR. TYPEUB(L).EQ.FIELD) F=AREAO(NK)/AREA(NK)
      IF(PDD(6).EQ.2.) F=1.
C     (PLANE 2-D)
      DO 510 K=1,NK
  510 ES2(K)= (F*AREA(K)-AREAO(K))/LAMBDA(K)
      IF(.NOT.AXIA) GO TO 550
C     (AXISYMMETRIC)
      K      = 2
      M      = MA+1
  520 ES2(K)= ES2(K)/(TWOPI*R(M))
      K      = K+1
      M      = M+1
      IF(K-NK) 520,520,550
```

```
C     EVALUATE MAXIMUM FLOW BALANCE ERROR, ES2MX
  550 IF(L.EQ.LO) ES2MX=0.
      DO 560 K=1,NK
  560 ES2MX = AMAX1(ES2MX,ABS(ES2(K)))
C     GET ACTUAL MAX VALUE OF ES2  ( WITH SIGN )
C     GET Z  AND R  AT MAX ES2
      CALL MINMAX ( ES2, 1, NK, ES2MIN, MINPOS, ES2MAX, MAXPOS )
      MRZPOS = MA + ( MAXPOS - 1 )
      IF ( ABS(ES2MIN) .LT. ABS(ES2MAX) ) GO TO 565
      ES2MAX = ES2MIN
      MRZPOS = MA + ( MINPOS - 1 )
  565 RMX    = R(MRZPOS)
      ZMX    = Z(MRZPOS)
C     SAVE MAX VALUES AT EACH STATION
      ES2SV(LCNT) = ES2MAX
      RMXSV(LCNT) = RMX
      ZMXSV(LCNT) = ZMX
C     TEST FOR LAST STATION
      LCHK   = L + LNEXT(L)
      IF ( LCHK .LT. LBSTA ) GO TO 575
C     FIND MAX VALUES FROM ALL STATIONS
      CALL MINMAX ( ES2SV, 1, LCNT, ES2MIN, MINPOS, ES2MAX, MAXPOS )
      MRZPOS = MAXPOS
      IF ( ABS(ES2MIN) .LT. ABS(ES2MAX) ) GO TO 570
      ES2MAX = ES2MIN
      MRZPOS = MINPOS
  570 RMX    = RMXSV(MRZPOS)
      ZMX    = ZMXSV(MRZPOS)

  575 IF (PRTES2 .LE. 2.) GO TO 600
      IF (X1(L) .LT.PDUM(8).OR.X1(L).GT.PRTES2) GO TO 722
      LMX1    = L
      LMX2    = L
      NKX1    = NK
      CALL MOVE (1,ES2,ES2X1,NK,1)
      IF (X1(L).EQ.PDUM(8)) WRITE(6,1661)
      GO TO 660

  600 IF (PRTES2.NE.2.) GO TO 722
      DATA ENTRY2/F/
      ES2MX0=0.
      DO 605 K=1,NK
  605 ES2MX0= AMAX1(ES2MX0,ABS(ES2(K)))
      IF (ENTRY2) GO TO 610
      ES2MX1= ES2MX0
      ES2MX2= ES2MX0
      LMX1 = L
      LMX2 = L
      NKX1    = NK
      NKX2    = NK
      CALL MOVE (2,ES2,ES2X1,NK,1, ES2,ES2X2,NK,1)
      ENTRY2 = .TRUE.
      GO TO 690
  610 IF(ES2MX0.LE.ES2MX1) GO TO 630
      ES2MX2 = ES2MX1
      LMX2 = LMX1
      NKX2    = NKX1
      CALL MOVE (1,ES2X1,ES2X2,NKX1,1)
      ES2MX1= ES2MX0
      LMX1 = L
      NKX1    = NK
```

```
      CALL MOVE(1,ES2,ES2X1,NK,1)
      GO TO 650
  630 IF(ES2MX0.LE.ES2MX2) GO TO 650
      ES2MX2= ES2MX0
      LMX2 = L
      NKX2    = NK
      CALL MOVE(1,ES2,ES2X2,NK,1)
  650 IF(MBB.NE.NM) GO TO 690
      WRITE (6,1661)
  660 WRITE(6,1660) X1(LMX1)
      M = MLB(LMX1)-1
      IF(LMX1.EQ.L) M=MA-1
      DO 670 K=1,NKX1
      M = M+1
  670 WRITE(6,1670) M,
     &                B(M),RHS(M),DS2(M),Z(M),R(M),PHI1(M),CURV(M),ES2X1(K)
      IF(LMX1.EQ.LMX2) GO TO 690
      LMX1 = LMX2
      NKX1    = NKX2
      CALL MOVE (1,ES2X2,ES2X1,NKX2,1)
      GO TO 660
 1661 FORMAT(1H1)
 1660 FORMAT (//9H STATION=,F8.3//
     & 5X,1HM,5X,1HB,10X,3HRHS,9X,3HDS2,9X,1HZ,10X,
     & 1HR,10X,4HPHI1,7X,4HCURV,7X,5HES2X1/)
 1670 FORMAT (1X,I6,F11.5,2(3X,F9.6),4(F11.5),3X,F9.6)
  690 CONTINUE

C****CALC COEFICIENT  B  AND  RHS  OF MATRIX EQUATION FOR DS2

C     SET SUPERSONIC OL INDICATOR
  722 SSOL  = .FALSE.

C     LOWER BOUNDARY
C      NOTE- MA=MLB(L)+1  FOR A STAGNATION P/INT
      M      = MLB(L)
      RHS(M)= 0.
      K      = 1
      M      = MA
      RHS(M)= 0.
      QGAMP = FGR(1)/(1.+FGR(1))
      BETSQP = 1.-VM(M)*VM(M)*QGAMP/(RG(1)*TS(1))
      B(M)  = BETSQP*(S2(M+1)-S2(M))/WQA(1)
C       IS FIRST POINT AN ISTAG=3 PT AND THE FIRST OF A DOUBLE POINT
         IF(WSTA(2).NE.WSTA(1)) GO TO 724
         IF(TYPELB(L).NE.FIELD) CALL ERROR1
C        TREAT FIRST PT AS DUMMY PT AND 2ND PT AS ISTAG#3 PT
         RHS(M)= ES2(1)-ES2(2)
         B(M)  = BDUMMY
         K      = K+1
         M      = M+1
         CALL GETIX
         ISTAG = 3
         CALL SAVIX
         RHS(M)= 0.
         B(M)  = BDUMMY
         GO TO 756

C     SPECIAL BOUNDARY TYPES
  724 IF((TYPELB(L).NE.FARFLD .AND. TYPELB(L).NE.FREE .AND.
     &    TYPELB(L).NE.PRES) .OR. (NODEVS.GE.NREFIN)) GO TO 756
```

```
      B(M)   = .5*(AREAB(2)-AREAO(1))*BETSQP*(S2(M+1)-S2(M))
      RHS(M)= AREA(2)-AREAO(2) - AREA(1)+AREAO(1)
      IF(VMLBSQ.NE.0.) RHS(M)=RHS(M)
     &        -(AREAO(2)-AREAO(1))*BETSQP*.5*(VMLBSQ/(VM(M)*VM(M))-1.)
      GO TO 756

C     INTERIOR POINT
  725 B(M)   = 0.
      IF(MM.NE.M) GO TO 726
      TSAVGM= .5*(TS(KM)+TS(KM1))
      QGAMM = FGR(KM)/(1.+FGR(KM))
      BETSQM= 1.-VM(MM)*VM(MM1)*QGAMM/(RG(KM)*TSAVGM)
      RHOVM = .5*(WQA(KM1)+WQA(KM))
      B(M)   = .5*BETSQM*(S2(MM)-S2(MM1))/RHOVM
  726 IF(WSTA(K+1).EQ.WSTA(K)) GO TO 728
      TSAVGP= .5*(TS(K)+TS(K+1))
      QGAMP = FGR(K)/(1.+FGR(K))
      BETSQP= 1.-VM(M)*VM(M+1)*QGAMP/(RG(K)*TSAVGP)
      RHOVP = .5*(WQA(K+1)+WQA(K))
      B(M)   = .5*BETSQP*(S2(M+1)-S2(M))/RHOVP + B(M)
  728 IF(MM.EQ.M .AND. B(M)*B(M-1).LT.0.) SSON=.TRUE.
      IF(WSTA(K+1).EQ.WSTA(K)) GO TO 757
  735 RHS(M)=(AREA(K+1)-AREAO(K+1)-AREA(K)+AREAO(K))/(WSTA(K+1)-WSTA(K))
    &        -(AREA(KM)-AREAO(KM)-AREA(KM1)+AREAO(KM1))/(WSTA(KM)-WSTA(KM
    &          1))
  756 KM1    = K
      MM1    = M
      KM     = KM1+1
      MM     = MM1+1
      GO TO 760

C     DOUBLE POINT (I.E. W(K+1)=W(K))
  757 RHS(M)= ES2(K)-ES2(K+1)

  760 K      = K+1
      M      = M+1
      IF(K.LT.NK) GO TO 725

C     UPPER BOUNDARY
C      NOTE- MB=MUB(L)-1  FOR A STAGNATION POINT
      M      = MUB(L)
      RHS(M)= 0.
      M      = MB
      RHS(M)= 0.
      QGAMM = FGR(K)/(1.+FGR(K))
      BETSQM= 1.-VM(M)*VM(M)*QGAMM/(RG(K)*TS(K))
      B(M)   = BETSQM*(S2(M)-S2(M-1))/WQA(K)
      IF(B(M).EQ.0.) B(M)=BDUMMY
C         DOUBLE FIELD POINT
      IF(WSTA(K).NE.WSTA(K-1)) GO TO 790
      IF(TYPEUB(L).NE.FIELD) CALL ERROR1
       B(M-1)= BDUMMY
      M      = M-1
      CALL GETIX
      ISTAG = 0
      CALL SAVIX

C     SPECIAL BOUNDARY TYPES
  790 IF((TYPEUB(L).NE.PRES .AND. TYPEUB(L).NE.FREE .AND.
    &     TYPEUB(L).NE.FARFLD) .OR. (NODENS.GE.NREFIN)) GO TO 800
      B(M)   = .5*(AREAO(K)-AREAO(K-1))*BETSQM*(S2(M)-S2(M-1))
```

```
      RHS(M)= AREA(K-1)-AREAO(K-1) - AREA(K)+AREAO(K)
  800 IF((B(M)*B(M-1)).LT.0.) SSOL=.TRUE.
C.....END CALC OF  B  AND  RHS

      IF (SSOL .AND. SLSWI(L).EQ.0.) SLSWI(L)=1
      RETURN
      END
```

```
*DECK NEWRAP
      SUBROUTINE NEWRAP(X,E,V)
*NEWRAP     OUTSIDE ITERATION PROCEDURE                              *NEWRAP*
C           TO BE USED WHEN INNER SELF CONVERGENT RELATIONS EXIST.

C     INPUT-
C      X       = ABSCISSA
C      E       = ERROR IN THE ORDINATE
C      V       - STORAGE FOR A 12 ELEMENT VECTOR
C     INPUT, FIRST ENTRY ONLY
C      V(1)    = CTR    = 0.
C      V(2)    = DEDX   = ESTIMATE OF THE SLOPE OF THE CURVE
C                 (X2=X1-E1/DEDX  IS THE FORMULA FOR THE SECOND X)
C                 (E/DEDX)  IS USED TO REDUCE DXMAX DURING THE ITERATION
C      V(3)    = XMOVE
C         ABS(XMOVE) = MAXIMUM DELTA X
C         SIGN(XMOVE)= DIRECTION TO THE BRANCH OF THE CURVE WITH SLOPE*SI

C     OUTPUT-
C      X       = NEXT X ESTIMATE

      COMMON /CNEWR / DEDXP(2),DXP(2),DX,WS

      DIMENSION   V(12),Q(12), XP(2),EP(2)
      EQUIVALENCE (CTR,Q(1)), (DEDX,Q(2)), (XMOVE,Q(3)),
     1            (DXMAX,Q(5)), (DXPREV,Q(6)), (OPSIGN,Q(7)), (SPAN,Q(8)
     2),          (XP,Q(9)), (EP,Q(11))

      LOGICAL SPAN

      DO 50 I = 1,12
   50 Q(I)   = V(I)
      IF(CTR.GE.30.) CALL ERROR1
      IF(CTR.NE.0.) GO TO 200

C     FIRST ENTRY
      DX     = -E/DEDX
      DXMAX = ABS(XMOVE)
      DXPREV= DXMAX
      OPSIGN= 0.
      SPAN   = .FALSE.
      GO TO 520

C     SECOND AND SUCCESSIVE ENTRIES, EVALUATE DEDXP(I) AND DXP(I)
  200 WS     = 0.
      DO 250 I=1,2
      DXP(I)= 0.
      IF(I.EQ.1) GO TO 220
      IF(CTR.LE.1.) GO TO 270
      IF(WS.EQ.0.) GO TO 220
      IF(.NOT.SPAN .OR. (E*EP(2).GT.0.)) GO TO 250
C        IF(.NOT.SPAN .OR. SAMESIGN(E,EP(2)))  DO NOT USE POINT 2
  220 DE     = E-EP(I)
      DX     = X-XP(I)
      IF(ABS(DE).LT.ABS(DX)/1.E15) GO TO 250
      IF(ABS(DX).LT.ABS(DE)/1.E15) GO TO 250
      DEDXP(I)= DE/DX
C        CHECK SIGN OF DEDXP(I)
      IF(DEDXP(I)*DEDX.LT.0.) GO TO 250
      DXP(I)= AMAX1(-DXMAX,AMIN1(-E/DEDXP(I),DXMAX))
      WS     = WS+1.
  250 CONTINUE
```

```
  270 IF(WS.NE.0.) GO TO 400

C     THE DEDXP HAVE INCORRECT SIGNS
C     TAKE MAX JUMP TOWARD THE CORRECT BRANCH
C     MAYBE DESIRED ORDINATE IS ABOVE/BELOW THE MAX/MIN OF THE CURVE
  350 IF(OPSIGN) 360,360,355
  355 DXMAX = .5*DXMAX
  360 OPSIGN= -1.
      DX    = XMOVE
      GO TO 520

C     REDUCE MAX DX IF DIRECTION OF ITERATION IS CHANGING
  400 IF(OPSIGN) 410,490,490
  410 DXMAX = .5*DXMAX
  490 OPSIGN= 1.

C     PEDICT NEXT ABSCISSA.  DEDXP HAVE THE CORRECT SIGNS
  500 DX    =(DXP(1)+DXP(2))/WS
      DXMAX = AMIN1(DXMAX,ABS(XMOVE))
C      -DXMAX.LE.DX.LE.DXMAX
  520 DX    = AMAX1(-DXMAX,AMIN1(DX,DXMAX))

C     SAVE CERTAIN GOODIES TO USE FOR FUTURE ENTRIES
  600 DXMAX = .25*DXMAX + .75*AMIN1(DXMAX,AMAX1(DXPREV,ABS(2.*E/DEDX)))
      DXPREV= ABS(DX)
      XP(2) = XP(1)
      EP(2) = EP(1)
      XP(1) = X
      EP(1) = E
      IF(EP(1)*EP(2).LT.0.) SPAN=.TRUE.
      CTR   = CTR+1.

C     SET X AND RETURN
      X     = X+DX
      DO 960 I=1,12
  960 V(I)  = Q(I)
      RETURN
      END
```

```
*DECK STALOO
      SUBROUTINE STALOO
*STALOO         LOOP THROUGH STATIONS AND EXECUTE FLOBAL      *STALOO*

C     STATION TABLE
C      INDEX= L=LO,LESTA
C      SCHOKE= STATION CHOKE INDICATOR (ADJWF,BRHS,WRIOUT)
C      MCL    = SHARP CORNER INDICATOR (BLDTBS)
C      MCL    = FIELD INDEX OF CONTROL STREAMLINE (PTMOVE,FLOBAL)
       COMMON /CHDATA/ X1(1),LNEXT(1),MLB(1),MUB(1),PRIM(1),
     1                 TYPELB(1),NAMELB(1),ILB(1),FLB(1),S1LB(1),
     1                 TYPEUB(1),NAMEUB(1),IUB(1),FUB(1),S1UB(1),
     &                 VMB(1),DWDV(1),X2CL(1),SLSWI(1),MCL(1),
     &                 ANGTE(1),PTTE(1),PSTE(1),FGRTE(1),RGTE(1),
     &                 ANGEXP(1),BSQEXP(475)
        DIMENSION      CRVLE(1),ANGLE(1)
        EQUIVALENCE    (SCHOKE,DWDV),(CRVLE,ANGTE),(ANGLE,PTTE)
        INTEGER        PRIM,TYPELB,TYPEUB,SCHOKE(1)
C
       COMMON /CFB   / L,MA,MB,PLB,PUB,WF,CHOKE,SUBSON, NK,PLBC,PUBC,
     1                 XCHOKE, TAREA,VMBC, WRQST,WCALC, QV(8),QVP(8),
     *                 JSUM,VMLBSQ
        LOGICAL                             CHOKE,SUBSON
       COMMON /IXORIG/ LHO,LHE, LBDO,LBDE, LTO,LTE, LWO,LWE, LFO,LFE,
     *                 LO,LESTA,  LDUM(8),
     *                 MO,NM, NJ,NFCOLS, MAXNJ,MAXOL,MAXNM,MAXLE,
     *                 LEO,LEE, LRO,LRE,LRD
        DIMENSION      LIMITS(24)
        EQUIVALENCE    (LIMITS,LHO)
       COMMON /CB    / B(300)
       COMMON /CFB2  / PASS1
        LOGICAL        PASS1
       COMMON / CMAX4 / DUMAX(4), LCNT
       COMMON /CSTALO/ NSSPTS
C
C     BEGIN LOOP THROUGH STATIONS
       CHOKE = .FALSE.
       JSUM  = 0
       L     = LO
       LCNT  = 0
       NSSPTS= 0

C     CALL BRHS AND FLOBAL
  410  PLB   = 0.
       PUB   = 0.
       WF    = 0.
       LCNT  = LCNT + 1
       CALL BRHS

C     COUNT NUMBER OF SUPERSONIC POINTS
       IF(SLSWI(L).NE.1.) GO TO 450
       MA    = MLB(L)+1
       MB    = MUB(L)-1
       DO 420 M=MA,MB
  420  IF(B(M).LT.0.) NSSPTS=NSSPTS+1

C     INDEX TO THE NEXT STATION (I.E. ORTHOGONAL)
  450  L     = L+LNEXT(L)
       IF(L.LT.LESTA) GO TO 410

       PASS1 = .FALSE.
       RETURN
```

END

```
*DECK STCW1
      OVERLAY(STC,2,2)
      PROGRAM STCW1
C     WRITE THE OVER-ALL STC DATA RECORD, KEY(5)=A.
      CALL WRIA
      CALL WRIOUT
      CALL WRIBDY
      CALL WRIATP
      RETURN
      END
```

```
*DECK USECDW
      BLOCK DATA USECDW
*USECDW          REPLACE STSW USE CARDS
      COMMON /ERASE3/ WDUM(400)
      COMMON /CPSM   / RSM(768)
      END
```

```
*DECK BLTBBL
      SUBROUTINE BLTBBL
CBLTBBL         BUILD BOUNDARY LAYER TABLES

      COMMON /BLDTA / BDNAME,LOWER,IBTYPE,N1,NI,CAPX1
      INTEGER         BDNAME
      LOGICAL               LOWER
      COMMON /BLDTA1/ BNAMSV
       INTEGER        BNAMSV
      COMMON /IXORIG/ LHO,LHE, LBTO,LBDE, LTO,LTE, LWO,LWE, LFO,LFE,
     *                LO,LESTA, LSO,LSE, LDO,LDE, LDUM(4),
     *                MO,NM,NJ,NFCOLS,MAXNJ,MAXOL,MAXNM,MAXLE,
     *                LEO,LEE,LRO,LRE,LRD
C   STATION  TABLE
      COMMON /CHDATA/ X1(1),LNEXT(1),MLB(1),MUB(1),PRIM(1),
     *                TYPELB(1),NAMELB(1),ILB(1),FLB(1)
      COMMON /ERASE2/ XI1(100),SWBL(100),ZW(100),RW(100),DSTR(100),
     *                DDSTR(100),VE(100),MACH(100),DUM(700)
      DIMENSION       LEDEX(1),LBZ1(1)
      EQUIVALENCE     (LEDEX,TYPELB),(LBZ1,MLB)
C     BOUNDARY LAYER TABLE
C     INDEX- LD=LDO,LDE--- INITIALLY 1,0
      DIMENSION       BNAME(1),LBLNXT(1),NSEP(2),SWREF(1),SIGN(1),
     *                SW(1),DSTAR(1),DDSTAR(1)
      INTEGER         BNAME
      EQUIVALENCE     (BNAME,X1),(LBLNXT,LNEXT),(NSEP,MLB),
     *                (SWREF,PRIM),(SIGN,TYPELB),(SW,NAMELB),
     *                (DSTAR,ILB),(DDSTAR,FLB)
      COMMON /BLSEP / NSLOC
      COMMON /REBL  / RESTBL
      LOGICAL         RESTBL
      COMMON /CPRINT/ RDUMM(6),PDUM(20)
      COMMON /CTABPR/ I1TAB
      COMMON /BLBDY / IBLB(60)
      INTEGER          UPPER
       INTEGER        BNAMC
      LOGICAL ENTRY1
      DATA ENTRY1/T/
      DATA UPPER,LOWR/5HUPPER,5HLOWER/
      DATA SWSAVE/0./
      IF( RESTBL ) GO TO 1111
      GO TO 1

C     RESTORE  TABLES

 1111 NUM    = LDE-LDO+1
      NMOVE = LESTA-LFO+1
      CALL MOVE(1,X1(LFO),X1(LDO),NMOVE,1)
      LFO    = LDO
      LESTA  = LESTA-NUM
      LO     = LO-NUM
      LFE    = LO-1
      LDO    = 1
      LDE    = 0
      RESTBL= .FALSE.


C     RELOCATE FLOW ADJUSTMENT AND STATION TABLES


    1 NUM    = 3*(NI-N1+1)+6
      MAXT   = LESTA+NUM
```

```
      IF( (MAXT-LHO).GT.MAXLE ) GO TO 1000
      LFONEW= LFO+NUM
      NMOVE = LESTA-LFO+1
      CALL MOVE(1,X1(LFO),X1(LFONEW),-NMOVE,1)
      LD    = LDE+1
      IF( LDE ) 2,2,5
    2 LDO   = LFO
      LD    = LDO
      LDE   = LDO+NUM-1
      GO TO 6
    5 LDE   = LDE+NUM
    6 LFO   = LFONEW
      LESTA = MAXT
      LO    = LO+NUM
      LFE   = LO-1
      LBLNXT(LD)= LD+NUM

C     SEQUENCE TO SET SWREF
      SWREF(LD)= 0.
      BNAMC = BDNAME
      LB    = LBF(BNAMC)
      IF( LB.NE.0 ) GO TO 18
C     COLLATED BOUNDARY--CHECK FOR LE
      BNAMC = BNAMSV
      LB    = LBF(BNAMC)
   18 IF( LEDEX(LB).EQ.0 ) GO TO 20
      IV1   = 1
      IV2   = (LEDEX(LB)-LBZ1(LB))/3+1
      SWREF(LD)= BARCS(BNAMC,IV1,IV2)
       GO TO 21
 20    IF(.NOT.LOWER)SWREF(LD)=SWBL(NI)
 21    BNAME(LD)=BDNAME

      SIGN(LD)= -1.
      IF( LOWER ) SIGN(LD)=1.
      NSEP(LD)= 0
      IF( NSLOC.NE.0 ) NSEP(LD)=LD+3*(NSLOC-N1+1)-3

C      MOVE BL PARAMETERS TO TABLE

   30 DO 40 LD1=N1,NI
      SW(LD)= SWBL(LD1)
      DSTAR(LD)= DSTR(LD1)
      DDSTAR(LD)=DDSTR(LD1)
      LD    = LD+3
   40 CONTINUE
      GO TO 2000
 1000 LUP   = UPPER
      IF( LOWER ) LUP=LOWR
      WRITE (6,1001) LUP,BDNAME
 1001 FORMAT(//2X,48HTABLE SPACE EXHAUSTED--BOUNDARY LAYER DATA FOR  ,
     * A6,2X,8HBOUNDARY,2X,A6,2X,9HNOT SAVED//)
      DO 999 LL=1,58,3
      IF( IBLB(LL).EQ.0 ) GO TO 2000
      IF( IBLB(LL).EQ.BDNAME ) IBLB(LL+1)=0
  999 CONTINUE

 2000 IF( PDUM(15).EQ.0. ) GO TO 2001
      I1TAB = LDO
      CALL TABPRT(6HSTABLT,X1,LESTA,6)
      CALL TABPRT(3HBLB,BLB,60,10)
```

```
2001 ENTRY1= .FALSE.
     RETURN
     END
```

```
*DECK LESTSQ
      SUBROUTINE LESTSQ(X,Y,IA,IB,NOC,NS, DY)
*LESTSQ          1ST/2ND ORDER CURV FIT BY LEAST SQUARE DEV   *LESTSQ*
C                *  VERSION 2
C                *  NO ROTATION OF AXIS
C                *  AUTOMATIC REDUCTION OF  NS  AND  NO  NEAR THE END PTS
       DIMENSION      X(10),Y(10),DY(10)

C     INPUT-
C      X(I),Y(I),I=IA,IB ARE ENTRY COORDINATES
C      NOC    = ORDER OF CURVE FIT + 1,  =2 OR 3
C      NS     = NUMBER OF POINTS INCLUDED IS EACH LEAST SQUARE FIT
C               MINIMUM  NS  IS =NO+NO-1,  ALSO,  NS  MUST BE ODD.

C     OUTPUT-
C      DY(I) = DEVIATION OBTAINED FROM THE CURVE FIT

      COMMON /ERASE / B(3),A(3,3)

      MIS    = (NS-1)/2
      IAA    = IA+1
      IBB    = IB-1
      DY(IA)= 0.
      IF(IAA.GT.IBB) GO TO 160
      DO 150 I=IAA,IBB

C     INITIALIZE TO ZERO
      DO 110 J=1,12
  110 B(J)=0.

C     SET UP MATRIX (A)(X)=(B)
      A(1,1)=NS
      MI     = MIN0(I-IA,MIN0(MIS,IB-I ))
      NO     = MIN0(NOC,MI+1)
      JA     = I-MI
      JB     = I+MI
      DO 120 J=JA,JB
      XP=X(J)-X(I)
      YP=Y(J)-Y(I)
      XP2=XP**2
      A(1,2)=A(1,2)+XP
      B(1)=B(1)+YP
      A(2,2)=A(2,2)+XP2
      B(2)=B(2)+YP*XP
      IF(NO-2) 115,120,115
  115 A(2,3)=A(2,3)+XP2*XP
      A(3,3)=A(3,3)+XP2**2
      B(3)=B(3)+YP*XP2
  120 CONTINUE
      A(2,1)=A(1,2)
      IF(NO-2) 125,130,125
  125 A(1,3)=A(2,2)
      A(3,1)=A(1,3)
  129 A(3,2)=A(2,3)

  130 CALL SIMEQ(NO,A,B,3)

      DY(I)=B(1)
  150 CONTINUE
  160 DY(IB)= 0.

      RETURN
```

END

```
*DECK RBWAKE
      SUBROUTINE RBWAKE
CRBWAKE             ADJUST WAKE TABLE FOR TE BL

      COMMON /CHDATA / X2W(1),LWNEXT(1),S1W(47)
      DIMENSION DST(1)
      EQUIVALENCE (DST,S1W)
      COMMON /CPI    / PI,TWOPI,PIQ2,PIQ4,TODEG,TORAD
      COMMON /IXORIG/ LHO,LHE, LBDO,LBDE, LTO,LTE, LWO,LWE, LFO,LFE,
     1                LO,LESTA, LSO,LSE, LDO,LDE, LDUM(4), MO,NM, NJ,
     2                NFCOLS, MAXNJ,MAXDL,MAXNM,MAXLE, LEO,LEE,
     3                LRO,LRE,LRD
      COMMON /TETAB/  ITE,XIT2(16),ANGTE(16),DSTTE(16),DDSTTE(16),
     *                RTE(16),ZTE(16)
     *               ,LWER(16)
       LOGICAL LWER

      IF( ITE.EQ.0 ) RETURN
      DO 100 I=1,ITE
      XI2    = XIT2(I)
      IF(XI2.LT.0.) GO TO 100

C    SEARCH FOR MATCHING XI2
      I2     = I
   10 I2     = I2+1
      IF(I2.GT.ITE) GO TO 200
      IF(XI2.NE.XIT2(I2)) GO TO 10
      XIT2(I2)= -1.

C    FIND MATCH IN WAKE TABLE
      LW     = LWO
   15 IF( LW.GT.LWE ) GO TO 100
      IF( XI2.EQ.X2W(LW)) GO TO 20
      LW     = LW+LWNEXT(LW)
      GO TO 15

C    ADJUST WAKE TABLE
   20 IKL    = I2
      IKU    = I
      IF( .NOT.LWER(I) ) IKU=I2
      IF( IKL.EQ.IKU ) IIL=I
      ANGCU  = ANGTE(IKU)+DDSTTE(IKU)
      RCU    = RTE(IKU)+DSTTE(IKU)*COS(ANGCU)
      ZCU    = ZTE(IKU)-DSTTE(IKU)*SIN(ANGCU)
      ANGCL  = ANGTE(IKL)-DDSTTE(IKL)
      RCL    = RTE(IKL)-DSTTE(IKL)*COS(ANGCL)
      ZCL    = ZTE(IKL)+DSTTE(IKL)*SIN(ANGCL)
      ANGM   = .5*(ANGCU+ANGCL)
      DR21   = RCU-RCL
      DZ21   = ZCU-ZCL
      THK    = DR21**2+DZ21**2
      IF( THK.EQ.0. ) GO TO 100
      DANG   = ATAN3(DR21,DZ21,ANGM)-PIQ2-ANGM
      THK    = SQRT(THK)*COS(DANG)
      DST(LW+4)= THK
  100 CONTINUE
  300 RETURN

  200 WRITE (6,201) XI2
  201 FORMAT (//2X,29HWARNING** MISSING TE AT--XI2=,F12.6//)
      GO TO 300
      END
```

```
*DECK SIMEQ
      SUBROUTINE SIMEQ(NN,A,B,MP)
CSIMEQ        PRO NO F3494A
C             THE EQUATIONS WHICH ARE SOLVED ARE AX=B, THE MATRIX
C             SIMEQ SIMULTANEOUS EQUATIONS
C             A AND THE VECTOR B ARE DESTROYED.  FOR PRINTOUT OF
C             THE MATRIX TO BE SOLVED SET MP NOT EQUAL TO ZERO
C             NN IS THE NUMBER OF EQUATIONS
      DIMENSION A(3,3),B(3)
   25 DO 140 K=1,NN
   30 P=A(K,K)
   35 ASSIGN 85 TO MT
   40 DO 55 I=K,NN
   45 IF(ABS(P)-ABS(A(I,K))) 50,55,55
   50 P=A(I,K)
   52 ASSIGN 65 TO MT
   53 L=I
   55 CONTINUE
   60 GO TO MT,(65,85)
   65 DO 80 J=K,NN
   70 P=A(K,J)
   75 A(K,J)=A(L,J)
   80 A(L,J)=P
   81 P=B(K)
   82 B(K)=B(L)
   83 B(L)=P
   85 B(K)=B(K)/A(K,K)
      IF(K-NN) 90,145,90
   90 L=K+1
      DO 100 J=L,NN
  100 A(K,J)=A(K,J)/A(K,K)
      DO 140 I=L,NN
      IF(A(I,K)) 120,140,120
  120 DO 125 J=L,NN
  125 A(I,J)=A(I,J)-A(I,K)*A(K,J)
  140 B(I)=B(I)-A(I,K)*B(K)
  145 L=NN-1
      DO 170 KK=1,L
      K=NN-KK
      P=0.0
      DO 165 J=K,L
  165 P=P+A(K,J+1)*B(J+1)
  170 B(K)=B(K)-P
 1999 RETURN
      END
```

```
*DECK SAB
      SUBROUTINE SAB(ENTRY)
CSAB         MAIN SUBROUTINE FOR BOUNDARY LAYER CALCULATION
      INTEGER          ENTRY

C     ON ENTRY=FIRST,  SAVE B,S2 ON TAPE4
C     ON ENTRY=LAST,  RESTORE B,S2

      COMMON /BCOLLT/ ZBCOL
      COMMON /BLDTA / BDNAME,LOWER,IBTYPE,N1,NI,CAPX1
      INTEGER          BDNAME
      LOGICAL                  LOWER
      COMMON /CB    / B(300)
      COMMON /CBITS/ BITS,BLANK
      COMMON /CS2   / S2(300)
      COMMON /IXORIG/ LHO,LHE, LBTO,LBDE, LTO,LTE, LWO,LWE, LFO,LFE,
     *                LO,LESTA, LSO,LSE, LDO,LDE, LDUM(4),
     *                MO,NM,NJ,NFCOLS,MAXNJ,MAXOL,MAXNM,MAXLE,
     *                LEO,LEE,LRO,LRE,LRD
      COMMON /ERASE2/ XI1(100),SW(100),ZW(100),RW(100),DUM(200),
     *                VE(100),DUM1(800)
      COMMON /ALLCOM/ DUM2(5),AXIA,DUM3(14)
      LOGICAL                   AXIA


      GO TO (1,2,45) , ENTRY
    1 REWIND 4
      WRITE  (4) (B(I),I=1,NM),(S2(I),I=1,NM)

C     SCAN TABLES TO SET N1

    2 IBTYPE= 1
      IF( RW(1).EQ.0 .AND. AXIA ) IBTYPE=2
      GO TO (5,8) , IBTYPE
    5 DO 6 I=1,NI
      IF( VE(I).LE.0. ) GO TO 20
    6 CONTINUE
      IBTYPE= 3
      N1    = 1
      GO TO 21
    8 DO 10 I=1,NI
      IF( RW(I).GT.0. ) GO TO 12
   10 CONTINUE
      RETURN
   12 N1    = I-1
      IF( N1.EQ.0 ) N1=1
      GO TO 21
   20 N1    = I
      IF( VE(I+1).LE.0. ) N1=N1+1
   21 IF( ZBCOL.EQ.BITS ) GO TO 30
C    CHECK FOR Z(NI).GE.ZBCOL
      IF(ZW(N1).GE.ZBCOL) GO TO 30
      NN1   = N1
      DO 25 I=NN1,NI
      IF( ZW(I).GE.ZBCOL ) GO TO 30
      N1    = N1+1
   25 CONTINUE
      CALL ERRORK(6HSAB    )

C     CALCULATE BL FOR BOUNDARY-- (BDNAME)

   30 CALL  SABBL
```

```
C      INSERT SMOOTHED DATA INTO  /BLTAB/

   40 CALL  BLTBBL
      GO TO 50
   45 REWIND 4
      READ  (4) (B(I),I=1,NM),(S2(I),I=1,NM)

   50 RETURN
      END
```

```
*DECK SABBL
      SUBROUTINE SABBL
*SABBL

      COMMON /CBITS / BITS,BLANK
       EQUIVALENCE    (BITS,IBITS), (BLANK,IBLANK)

      COMMON /ALLCOM/ MACHA,DUMCA(4),AXI,DUMCB(14)
       REAL           MACHA,MACHO,MACHOS
       LOGICAL        AXI
      COMMON /BLDTA / BDNAME,LOWER,IBTYPE,N1,NI,CAPX1
       LOGICAL         LOWER
      COMMON /ERASE2/ DSTAR(100),SW(100),ZW(100),RW(100),DSTR(100),
     1                DDSTR(100),VE(100),MACH(100),MACHSQ(100),CP(100),
     2                POPT(100),PW(100),REXP(100),PR(100),CAPX(100)
       DIMENSION      XW(1),YW(1)
       EQUIVALENCE    (ZW,XW),(RW,YW)
       REAL           MACH,MACHSQ
      COMMON /VISCOS/ TREF,MUREF,SCON
       REAL            MUREF
      COMMON /CGRAV/ CG
      COMMON /BLSEP / NSLOC
      COMMON /IXORIG/ LHO,LHE, LBTO,LBTE, LTO,LTE, LWO,LWE, LFO,LFE,
     &                LO,LESTA, LSO,LSE, LDO,LDE, LDUM(4),
     &                MO,NM,NJ,NFCOLS,MAXNJ,MAXOL,MAXNM,MAXLE,
     &                LEO,LEE, LRO,LRE,LRD
      COMMON /SABCHN/ CHNSAB
       INTEGER        CHNSAB
C     TABLE OF CONVECTED PROPERTIES
C      INDEX= LT=LTO,LTE
C      CH     = CHANNELNAME
C      LTNEXT= INDEX INCREMENT TO THE NEXT CHANNEL
C      LPSI   = RELATIVE LOCATION OF PSI LIST
C      NPT    = NO. OF PSI, TT, PT AND RCU VALUES
C      LTT    = RELATIVE LOCATION OF TT LIST
C      LPT    = RELATIVE LOCATION OF PT LIST
C      LRCU   = RELATIVE LOCATION OF RCU LIST
      COMMON /CHDATA/ CH(1),LTNEXT(1),NPT(1),LPSI(1),LTT(1),LPT(1),
     1                LRCU(1),
     2                CRG(1),CPGJ(1),C2CP(1),GGAM(1),FGT(1),FGP(1),
     3                FGR(1),AREATB(485)
       INTEGER CH
      DIMENSION XCH(1)
      EQUIVALENCE (CH,XCH)
       DIMENSION    LHNEXT(1),TTT(1),PTT(1)
       EQUIVALENCE  (LHNEXT,LTNEXT),(TTT,AREATB(3)),(PTT,AREATB(4))

      DIMENSION       REX(100),THETA(100),DELTA(100),P(100),F1(100),
     1                F2(100),F3(100),CF(100), ISEP(100),DCPWDX(100),
     2                F(100),AVG(100)
     3                ,CPK(100),DCPK(100)
       EQUIVALENCE     (DCPQDX,DCPK)

      DATA PI/3.14159/
      DATA KSEP/3HSEP/

*A*
      NSLOC   = 0
      N2      = N1+1
      NT      = NI-N1+1
C
C  LOCATE ENTRIES IN CHANNEL AND CONVECTED PROP. TABELS
```

```
C
    1 LT     = LTO
    2 IF (LT.GT.LTE) CALL ERROR1
      IF (CH(LT).EQ.CHNSAB) GO TO 3
      LT     = LT+LTNEXT(LT)
      GO TO 2
C
    3 IF (LHE.EQ.(LHO-1)) GO TO 12
    4 LH     = LHO
    5 IF (LH.GT.LHE) GO TO 12
      IF (CH(LH).EQ.CHNSAB) GO TO 10
      LH     = LH+LHNEXT(LH)
      GO TO 5
C
   10 MACHO = CRG(LH)
      GO TO 13
   12 MACHO = MACHA
   13 TTO    = TTT(LT)
      PTO    = PTT(LT)
      GAM    = 1./OGAM(LT)
      RG     = CRG(LT)
      IF( MACHO.EQ.BITS ) MACHO=MACH(N1)
      IF( MACHO.EQ.0. ) MACHO=MACH(N2)
      MACHOS= MACHO*MACHO
  180 GAM1   = GAM/(GAM-1.)
      CAPX2 = 0.
      IF(CAPX1.NE.0.) CAPX2=CAPX1
      CVP    = RG/(GAM-1.)
      TSO    = TTO/(1.+.5*(GAM-1.)*MACHO**2)
      PSO    = PTO*(TSO/TTO)**GAM1
      VMAX   = SQRT(2.*GAM1*RG*TTO)
      PTOQPO= (1.+(GAM-1.)*.5*MACHO*MACHO)**GAM1
      CPT    = .5*GAM*MACHO*MACHO
      DO 190 I=N1,NI
      MACHSQ(I)=MACH(I)*MACH(I)
      PQPT(I)=(CP(I)*CPT+1.)/PTOQPO
      PW(I) = PTO*(1.-(VE(I)/VMAX)**2)**GAM1
  190 CONTINUE
*   CALCULATE EXP
      RHOT   = PTO/(RG*TTO)*CG
      GAMM   = 1.+(GAM-1.)*.5*MACHO*MACHO
      RHOS   = RHOT*GAMM**(-(1./(GAM-1.)))
      TSO    = TTO/GAMM
      V      = MACHO*SQRT(GAM*RG*TSO)
      AMU    = MUREF*(TSO/TREF)**1.5*(TREF+SCON)/(TSO+SCON)
      AL     = (SW(NI)-SW(N1))/2.
      RE     = RHOS*V*AL/AMU
      EXP    = 1.25
      IF(RE.GT.2.E7) EXP=1.2
      IF(EXP.EQ.1.25) GO TO 205
      CON1   = .23
      CON2   = .022
      CON3   = .028
      CON4   = -(1./6.)
      GO TO 210
  205 CON1   = .37
      CON2   = .036
      CON3   = .046
      CON4   = -.2

  210 IF(.NOT.AXI) EXP=0.
```

```
      DO 215 I=N1,NI
      REXP(I)=0.
      IF( .NOT. AXI ) REXP(I)=1.
      IF(RW(I).GT.0.) REXP(I)=RW(I)**EXP
      PR(I) = (MACH(I)/(1.+MACHSQ(I)*.2))**4*REXP(I)
  215 CONTINUE

*B* CALCULATE SW,CAPX,REX
      GAM12 = (GAM-1.)*.5
      AMU   = MUREF*(TTO/TREF)**1.5*(TREF+SCON)/(TTO+SCON)
      Z2    = SQRT(GAM/((GAM-1.)*CVP*TTO))
      GAMP  = (GAM-2.)/(GAM-1.)
      Z4A   = SCON/TTO
      Z4D   = 1./(1.+Z4A)
      Z1M   = PTO*CG/AMU
      CAPX(N1)=CAPX2
      CALL SETM(1,IBLANK,ISEP,100)
      DO 220 N=N2,NI
      I     = N-1
      SWD   = SW(N)-SW(I)
      AINT  = (PR(N)+PR(I))*.5*SWD
      CAPX(N)= AINT/PR(N)+CAPX(I)*PR(I)/PR(N)
      TTOT  = 1.+GAM12*MACHSQ(N)
      Z1    = MACH(N)*Z1M
      Z3    = TTOT**GAMP
      Z4    = (1./TTOT+Z4A)*Z4D
      REX(N)=Z2*Z1*Z3*Z4
  220 CONTINUE

      CALL LSPFIT(SW(N1),RW(N1),NT, SW(N1),F3(N1),NT,1)

      TTOT  = 1.+GAM12*MACHSQ(N1)
      Z1    = MACH(N1)*Z1M
      Z3    = TTOT**GAMP
      Z4    = (1./TTOT+Z4A)*Z4D
      REX(N1)=Z2*Z1*Z3*Z4

*C* CALCULATE THETA,DSTAR,DELTA
      K2    = 0
      CALL SETM(1,0.,F,100)
      THETA(N1)=0.
      DSTAR(N1)=0.
      DELTA(N1)=0.
      F(N1) = 0.
      FMAX  = -10.**6
      DO 230 I=N1,NI
      IF(I.NE.N1) GO TO 225
      IF(CAPX2.EQ.0.) GO TO 230
  225 CAPXX = CAPX(I)*(REX(I)*CAPX(I))**CON4
      THETA(I)=CON2*((1.+MACHSQ(I)*.1)**(-.7))*CAPXX
      DSTAR(I)=CON3*(1.+MACHSQ(I)*.8)**(.44)*CAPXX
      DELTA(I)=CON1*CAPXX
      IF(I.EQ.N1) GO TO 230
*  CHECK FOR SEPARATION
      IF( PW(I+1).LE.PW(I) .OR. I.LE.K2 ) GO TO 2290
      K     = I
 1225 K     = K+1
      IF( K.GT.NI ) GO TO 1226
      IF( PW(K).GT.PW(K-1) ) GO TO 1225
 1226 K1    = I
      IF( K1.EQ.(K-1) ) GO TO 2290
```

```
      K2     = K-1
      K1M    = K1-1
      IF( MACH(K1M).EQ.0. ) K1M=K1
      MACHOS= MACHSQ(K1)
      CPK(K1M)= 1.
      DO 226 K=K1M,K2
      IF( MACH(K).EQ.0. ) GO TO 226
      CPK(K)=1.-MACHSQ(K)/MACHOS
  226 CONTINUE
      DO 227 K=K1,K2
  227 DCPK(K)=(CPK(K)-CPK(K-1))/(SW(K)-SW(K-1))
      K2M    = K2-1
      DO 228 K=K1,K2M
  228 DCPK(K)=(DCPK(K)+DCPK(K+1))*.5
      DO 229 K=K1,K2
      SWK    = SW(K)-SW(I)+CAPX(I)
      F(K)   = CPK(K)*(SQRT(ABS(SWK*DCPK(K))))*((1E-6)*REX(K)*SWK)**(-.1))
  229 CONTINUE
 2290 FMAX   = AMAX1(F(I),FMAX )
      IF( FMAX.LT. .5 ) GO TO 230
C     SEPARATION
      ISEP(I)= KSEP
      IF( NSLOC.EQ.0 ) NSLOC=I
  230 CONTINUE
      N3     = I

*D* CALCULATE P FOR TOD
  234 P(N1) = 0.
      DO 240 I=N2,N3
      K      = I-1
      A1     = (RW(K)+RW(I))*.5
      A2     = (DSTAR(K)+DSTAR(I))*.5
      IF(AXI) GO TO 235
      P(I)   = A2*(PW(I)-PW(K))+P(K)
      GO TO 240
  235 P(I)   = 2.*PI*A1*A2*(PW(I)-PW(K))+P(K)
  240 CONTINUE

*   CALCULATE TOD, TOTAL SKIN FRICTION DRAG
      IF(AXI) GO TO 250
      DRM    = GAM*((PW(NI)*MACHSQ(NI)*THETA(NI))-(PW(N1)*MACHSQ(N1)
     1         *THETA(N1)))
      GO TO 255
  250 DRM    = GAM*((PW(NI)*MACHSQ(NI)*THETA(NI)*2.*PI*RW(NI))-
     1         (PW(N1)*MACHSQ(N1)*THETA(N1)*2.*PI*RW(N1)))
  255 TOD    = DRM-P(NI)

*E* CALCULATE CF
  300 DO 310 I=N1,N3
      RX=1.
      IF(AXI)RX=RW(I)
      F1(I)  = RX*PW(I)*MACHSQ(I)
      F2(I)  = F1(I)*THETA(I)
      REX(I)=REX(I)*(SW(I)-SW(N1))
  310 CONTINUE

      NN     = N3-N1+1
      CALL LSPFIT(SW(N1),F2(N1),NN,SW(N1),CF(N1),NN,1)

      N11=N1
      IF(MACH(N1).NE.0.) GO TO 319
```

```
      N11=N2
      CF(N2)= 0.
  319 DO 320 I=N11,N3
      CF(I) = 2.*CF(I)/F1(I)-2.*DSTAR(I)*F3(I)/(GAM*PW(I)*MACHSQ(I))
  320 CONTINUE
      CALL LESTSQ(SW,DSTAR,N1,NI,3,5,DSTR)
      NN     = NI
      DO 327 I=N1,NI
  327 DSTR(I)= DSTR(I)+DSTAR(I)
      CALL LSPFIT(SW(N1),DSTR(N1),NN,SW(N1),DDSTR(N1),NN,1)

*   WRITE OUTPUT
      WRITE (6,1002)
 1002 FORMAT(//37X,30H B O U N D A R Y     L A Y E R//)
      WRITE (6,1004) (I,XW(I),THETA(I),DSTAR(I),DELTA(I),REX(I),
     1         CAPX(I),CF(I),SW(I),DSTR(I),DDSTR(I),ISEP(I),F(I),I=N1,N3)
 1004 FORMAT(4X,1HI,5X,2HXW,4X,5HTHETA,5X,5HDSTAR,4X,5HDELTA,5X,3HREX,
     * 7X,4HCAPX,6X,2HCF,8X,2HSW,6X,4HDSTR,4X,5HDDSTR,5X,3HSEP,8X,
     * 4HFSEP/
     * (2X,I3,F9.4,3F9.5,F9.0,F9.4,F9.5,F10.4,2F9.5,2X,A6,F13.6))
      WRITE (6,1003) TDD
 1003 FORMAT(/6X,20HTOTAL FRICTION DRAG=,F14.5)

  900 RETURN
      END
```

```
*DECK WRIA
      SUBROUTINE WRIA
*WRIA--         WRITE THE KEY(5)=A  STC DATA RECORD          @WRIA@

C   CHDATA, CONVTB
C    CHANNEL INPUT DATA TABLE
C     INDEX- LH=LHO,LHE
C    TABLE OF CONVECTED PROPERTIES
C     INDEX- LT=LTO,LTE
C     CH     = CHANNELNAME
C     LTNEXT= INDEX INCREMENT TO THE NEXT CHANNEL
C     LPSI   = RELATIVE LOCATION OF PSI LIST
C     NPT    = NO. OF PSI, TT, PT AND RCU VALUES
C     LTT    = RELATIVE LOCATION OF TT LIST
C     LPT    = RELATIVE LOCATION OF PT LIST
C     LRCU   = RELATIVE LOCATION OF RCU LIST
      COMMON /CHDATA/ CHNAM(1),LHNEXT(1),WTFLOW(1),TTO(1),PTO(1),
     1                TSO(1),PSO(1),MACHO(1),AO(1),VARY(1),
     2                RG(1),GAM(1), NR(1),NC(1),TAB(6),
     4                BB(75)
       LOGICAL        VARY
       INTEGER CHNAM
       DIMENSION      VO(1)
       REAL           MACHO
       EQUIVALENCE    (VO,MACHO)
      DIMENSION       CH(1),LTNEXT(1),NPT(1),LPSI(1),LTT(1),LPT(1),
     1                LRCU(1),
     2                CRG(1),CPGJ(1),C2CP(1),QGAM(1),FGT(1),FGP(1),
     3                FGR(1),AREATB(485)
       INTEGER CH
      DIMENSION XCH(1)
      EQUIVALENCE (CH,XCH)
       EQUIVALENCE    (CHNAM,CH),(LHNEXT,LTNEXT),(WTFLOW,NPT),
     &                (TTO,LPSI),(PTO,LTT),(TSO,LPT),(PSO,LRCU),
     &                (MACHO,CRG),(AO,CPGJ),(VARY,C2CP),
     &                (RG,QGAM),(GAM,FGT),(NR,FGP),(NC,FGR),
     &                (TAB,AREATB)
       DIMENSION      TABLES(1)
       EQUIVALENCE    (CHNAM,TABLES)
C
      COMMON /BCOMMN/ PROGM(9),FILIN,FILOT
       LOGICAL        FILIN, FILOT
      COMMON /ADAM01/ NAME(6),ADDRES(6),TITLE(6),IDENT(6)
      COMMON /ALLCOM/ MACHA,PSA,TSA,PTA,TTA, AXIA,RGA,GAMA,
     &                MACHC,PSC,TSC,PTC,TTC, AXIC,RGC,GAMC,
     &                DAXIT,SCALEA,TTE,CHOTST
       LOGICAL        AXI,AXIA,AXIC,CHOTST
       REAL           MACHA(1),MACHC
      COMMON /BENDIN/ NBCIN(2),ACF(2)
      COMMON /CB     / B(300)
      COMMON /CBITS / BITS,IBLANK
      COMMON /CCRX   / CRX(6)
      COMMON /CGRAV / CG
      COMMON /CIADIN/ RHOBAS,RHOAMP,IADM
      COMMON /CINNER/ INRCTR,RDUM,NINNER(16),CNVF(16)
      COMMON /CISBOT/ FARFLD(2),FREE(2),PRES(2),PSPISV,NZP,
     &                ZP(10),RSP(10),NZP1
       INTEGER        FARFLD,FREE,PRES,PSPISV
      COMMON /CLINES/ LINES,OMITFK,PTITLE(6)
       LOGICAL                OMITFK
      COMMON /CM     / JNS(300)
      COMMON /CMAX4 / ES2MX, ZMX, RMX, DS2MX,  IDUMY
```

```
      COMMON /CMAXIT/ MAXREF,NREFIN,GREFIN,TI
       LOGICAL                       GREFIN
      EQUIVALENCE (MAJCTR,NREFIN)
      COMMON / CNORM / RHL,RM,AHL,ARM
      COMMON /CPRINT/ PDUM1(3),PREFIN,PREFN2,PDUM(11)
      COMMON /CPRPRN/ PRPRN
       INTEGER        PRPRN
      COMMON /CPTMOV/ VELPOT,ICOR,NODENS,CPTDUM
       LOGICAL        VELPOT
      COMMON /CR     / RF(300)
      COMMON /CREFIN/ DREFIN,SG21,VMG1,VMG2, NGR,NGZ,SGR(10),GR(10),
     &                SGZ(10),GZ(10)
      COMMON /CS1    / S1(300)
      COMMON /CS2    / S2(300)
      COMMON /CSS    / SSFML,SSEF,SSEANG,SSDF,SSFEND,SSFND1,
     &                DSS(2),RHOW,RHOWSS,TSIC,RHOC,RHOCSS
       INTEGER        SSFML
       LOGICAL              SSEF,        SSDF
      COMMON /CTE    / TOLWF, TOLWFU, TEXI2, TWF, TERWF, JRET
      COMMON /CTOLRL/ TOLRL,MAXSWP,CLEN,DTOLR1,TOLES2,NSWP,
     &                DS1DMP,DS1DP1,DTOLR2(4),SG1REF,TOLINR
      COMMON /CTHICK/ NTHKX,NTHKY,THKX(25),THKY(25),THIK2D(250)
      COMMON /CVM    / VMF(300)
      COMMON /CZ     / ZF(300)
      COMMON /IXORIG/ LHO,LHE, LBDO,LBDE, LTO,LTE, LWO,LWE, LFO,LFE,
     &                LO,LESTA,LSO,LSE,LDUM(6),
     &                MO,NM, NJ,NFCOLS, MAXNJ,MAXOL,MAXNM,MAXLE,
     &                LEO,LEE, LRO,LRE,LRD
       DIMENSION      LIMITS(24)
       EQUIVALENCE    (LIMITS,LHO)
      COMMON /SLTAB / W(128),X2(128),SLCHN(128)
       INTEGER        SLCHN
      COMMON /CAO    / AOSV
      COMMON /CPI    / PI,TWOPI,PIO2,PIO4,TODEG,TORAD
      COMMON /CHNFPT/ ICHN(10),WTFS(10),WTFA(10),WPTO(10),WTTO(10), IC
      COMMON /TAPES / NTAPO,NTAPN
      COMMON /BLBDY / BLB(60)
      DIMENSION IBLB(60)
      EQUIVALENCE (IBLB,BLB)
      COMMON /VISCOS/ TREF,MUREF,SCON
      REAL                  MUREF

      LOGICAL STCFIL
      DATA STCFIL/T/
      DATA KA/1HA/

      ATLDS2= CLEN*TOLES2
      IF(ES2MX.GT.ATLDS2) WRITE(6,1001)
 1001 FORMAT (//////60H ***  THE SOLUTION HAS NOT CONVERGED TO THE INPUT
     & TOLERANCE.)
      IF(GREFIN) WRITE(6,1002)
 1002 FORMAT (//////65H ***  THE INPUT GRID REFINEMENT CRITERIA HAVE NOT
     & BEEN SATISFIED.)

      OMITFK= .TRUE.
      IF(FILOT) OMITFK=.FALSE.
      CALL FHEAD(64)
      TSC   = TSA
      TTC   = TSC*(1.+(GAMA-1.)*.5*MACHA**2)
      PTC   = PSC*(TTC/TSC)**(GAMA/(GAMA-1.))
   55 WRITE(6,1000) AXI,MACHA,RGA,TSC,GAMA,PSA,TTB,PTC,CHOTST,TTC,CG,
     &              NUCIN,ACF
```

```
1000 FORMAT (/15H GENERAL INPUT-/6X,7HAXI    =,L8,26X,7HMACHO  =,F8.4/
    &6X,7HRG     =,F8.2,26X,7HTSO    =,F8.2/ 6X,7HGAM    =,F8.4,26X,
    &7HPSO    =,F8.3/ 6X,7HTTE    =,F8.3,26X,7HPTO    =,F8.3/ 6X,7HCHOTST=
    &,L8,26X,7HTTO    =,F8.2/6X,7HCG     =F8.3//27H STREAMLINE END CONDIT
    &IONS-/6X,7HNBCIN =,2I8/ 6X,7HACF    =2F8.3//)

     WRITE (6,1005) SSFML,SSEANG,SSEF,SSDF
1005 FORMAT(43H CURVATURE CALCULATION FOR SUPERSONIC FLOW-/
    &6X,7HSSFML =,I8,19H   (FORMULA NUMBER)/
    &6X,7HSSEANG=,F8.3,43H   (INLET FLOW ANGLE, DEGREES, SSEF=T ONLY)/
    &/38H SUBSONIC/SUPERSONIC BRANCH SELECTION-/
    &6X,7HSSEF  =,L8,37H   (SUPERSONIC ENTERING FLOW, T OR F)/
    &6X,7HSSDF  =,L8,56H   (SUPERSONIC FLOW DOWNSTREAM OF CHOKE STATION
    &, T OR F))

     WRITE (6,1010) (GR(I),I=1,NGR)
     WRITE (6,1011) (SGR(I),I=1,NGR)
     IF(NGZ.EQ.0) GO TO 65
     WRITE (6,1012) (GZ(I),I=1,NGZ)
     WRITE (6,1013) (SGZ(I),I=1,NGZ)
  65 WRITE (6,1014) VMG1,VMG2,CRX
1010 FORMAT(/1X19HGRID SIZE CRITERIA-/6X7HNGR/GR=10F8.2)
1011 FORMAT (6X,7HSGR    =,10F8.2)
1012 FORMAT (/6X,7HNGZ/GZ=,10F8.2)
1013 FORMAT(6X,7HSGZ    =,10F8.2)
1014 FORMAT(/6X,7HVMG1   =,F8.2,25X,7HVMG2   =,F8.2//6X,7HCRX    =,6F8.3)

     WRITE (6,1030) NM,MAXNM, LESTA,MAXLE, NJ,MAXNJ
1030 FORMAT(/1X19HMEMORY UTILIZATION-/24X17HUSED      AVAILABLE/6X11HGRID
    * POINTSI11,I10,/6X6HTABLESI16,I10,/6X11HSTREAMLINESI11,I10,)

     ATLDS2= CLEN*TOLES2
     WRITE(6,1040) MAXREF,NREFIN,INRCTR,TOLINR,TOLES2,TOLWF,
    &                  CLEN,ATLDS2,ES2MX,
    &                  DS1DMP,DS1DP1,NODENS,RHOC,RHOW,RHOCSS,RHOWSS
1040 FORMAT (/18H CONVERGENCE DATA-/
    &6X,7HMAXREF=,I8,3X,21H(MAXIMUM REFINEMENTS)/
    &6X,7HNREFIN=,I8,24H - NUMBER OF REFINEMENTS/
    &6X7HINRCTR=,I8,42H - NUMBER OF ITERATIONS IN LAST REFINEMENT//
    &6X,7HTOLINR=, E8.1,47H   (INNER ITERATION TOLERANCE ON S.L. MOVEM
    &ENT)/6X,7HTOLES2=, E8.1,37H   (FINAL TOLERANCE ON S.L. MOVEMENT)
    &/6X,7HTOLWF =, E8.1,3X,40H(T.E. CLOSURE FRACTIONAL FLOW TOLERANCE
    &)/
    & 6X,7HCLEN  =,0PF8.3,52H - CHARACTERISTIC LENGTH BASED ON GRID SIZ
    &E CRITERIA/   E21.1,53H - ABSOLUTE TOLERANCE ON S.L. MOVEMENT (=TO
    &LES2*CLEN)/
    &6X,7HMAXES2=, E8.1,42H - LARGEST S.L. MOVEMENT ON LAST ITERATION/
    &/6X,7HDS1DMP=,0PF8.3,54H   (STREAMWISE PT MOVEMENT DAMPING, =0 FOR
    & NO DAMPING)/
    &6X7HDS1DP1=,F8.3,53H   (ADDITIONAL STREAMWISE DAMPING ON FIRST PAS
    &S ONLY)/
    &6X7HNODENS=,I8,58H   (REFINEMENT LEVEL TO WHICH CONSTANT DENSITY I
    &S ASSUMED)/
    &6X,7HRHOC  =,F8.3,10H   RHOW  =,F7.3,10H   RHOCSS=,F7.3,
    &10H   RHOWSS=F7.3,34H   (CORRECTION EQ. DECEL. FACTORS))
     LINES = 64
     CALL FHEAD(13)
     WRITE (6,1090) FARFLD
     WRITE (6,1092) IADM,RHOBAS,RHOAMP,TOLRI
1090 FORMAT (/26H SPECIAL BOUNDARY OPTIONS-/ 6X,7HFARFLD=,2(2X,A6))
1092 FORMAT(/ 28H MATRIX SOLUTION PARAMETERS-/6X,7HIADM  =,I8,3X,70H(=-
    11,0,1, FOR STREAMLINE, ALTERNATING, AND ORTHOGONAL LINE RELAXATION
```

```
     2)/ 6X,7HRHOBAS=,F8.3,3X,33H(ACCELERATION FACTOR, BASE LEVEL)/
     36X,7HRHOAMP=,F8.3,3X,45H(ACCELERATION FACTOR, AMPLITUDE OF VARIATI
     4ON)/  6X,7HTOLRL =,  E8.1,3X,30H(TOLERANCE RELATIVE TO MAXDS2)  )
C     PRINT HIGHLIGHT AND MAX. BODY RADII AND AREAS
      AHL    = RHL
      IF(AXIA) AHL=PI*RHL*RHL
      ARM    = RM
      IF(AXIA) ARM=PI*RM*RM
      WRITE (6,1091) RHL,AHL,RM,ARM
 1091 FORMAT (//6X, 17HHIGHLIGHT RADIUS=,F8.3,4X,15HHIGHLIGHT AREA=,
     * F8.3/6X,17HMAX. BODY RADIUS=, F8.3,4X,15HMAX. BODY AREA=,F8.3)
      WRITE(6,1093) AOSV
 1093 FORMAT (6X,17HMASS FLOW RATIO =,F8.3)
C     PRINT CHANNEL TABLE OF CONTENTS
      CALL FHEAD(2)
      WRITE (6,1060)
      LH     = LHO
   80 IF(LH.GE.LHE) GO TO 96
       MOREL = 4
      IF(NR(LH).NE.0) MOREL=MOREL+2+NR(LH)
      CALL FHEAD(MOREL)
      LH2    = LH+9
      WRITE (6,1070) CHNAM(LH),(WTFLOW(LHX),LHX=LH,LH2)
      NCX    = NC(LH)
      IF(NR(LH).LE.0) GO TO 95
      WRITE (6,1080) (TAB(I),I=1,NCX)
      CALL TABPRT(2HB=,BB(LH),NCX*NR(LH),NCX)
   95 LH     = LH+LHNEXT(LH)
      GO TO 80
   96 CONTINUE
 1060 FORMAT(/1X26HCONTENTS OF CHANNEL TABLE-)
 1070 FORMAT(//6X7HCHN    =2X,A6,5X7HWTFLOW=  E12.4,/6X7HTTO    =  F8.2,5X
     *7HPTO    =F8.3,5X7HTSO    =F8.2,5X7HPSO    =F8.3,/6X7HMACHO =F8.4,5X7
     *HAO     =  E12.4,1X7HVARY   =L8,/6X7HRG     =  F8.2,5X7HGAM    =F8.4,)
 1080 FORMAT(/6X7HNB/TAB=2X,A6,1H,5X,A6,1H,5X,A6,1H,5X,A6,1H,5X,A6,1H,)
C     LOOP THROUGH CHANNELS TO PRINT FLOW RATES, PRESSURES, AND TEMP
      RHOINF= PSA/(RGA*TSA)
      VINF  = SQRT(GAMA*RGA*TSA)*MACHA
      WTNORM= RHOINF*VINF*PI
      J2     = 0
      IC     = 0
  100 J2     = J2+1
      JCHN   = SLCHN(J2)
  105 IF(JCHN.NE.SLCHN(J2+1) .OR. J2.EQ.NJ) GO TO 110
      J2     = J2+1
      GO TO 105
  110 IC     = IC+1
      WTFA(IC)=W(J2)/WTNORM
      IF( RGA.NE.1. ) WTFA(IC)=W(J2)
      ICHN(IC)=JCHN
      LT     = LTO
  115 IF(JCHN.EQ.CH(LT)) GO TO 120
      LTP    = LT+LTNEXT(LT)
      IF(LTP.GE.LTE) GO TO 120
      LT     = LTP
      GO TO 115
  120 LTP    = LT+LPSI(LT)+NPT(LT)-1
      WTFS(IC)=XCH(LTP)/WTNORM
      IF( RGA.NE.1. ) WTFS(IC)=XCH(LTP)
```

```
      WPTO(IC)=PTC
      WTTO(IC)=TTC
      LH     = LHO
  122 IF(JCHN.EQ.CHNAM(LH)) GO TO 124
      LHP    = LH+LHNEXT(LH)
      IF(LHP.GE.LHE) GO TO 128
      LH     = LHP
      GO TO 122
  124 IF(PTO(LH).NE.BITS .AND. PTO(LH).NE.0.) WPTO(IC)=PTO(LH)
      IF(TTO(LH).NE.BITS .AND. TTO(LH).NE.0.) WTTO(IC)=TTO(LH)
  128 IF(J2.LT.NU) GO TO 100
  130 WRITE (6,1130) (ICHN(I),WTFS(I),WTFA(I),WPTO(I),WTTO(I),I=1,IC)
 1130 FORMAT (/49H CHANNEL FLOW RATES, PRESSURES, AND TEMPERATURES-//
     * 16X,9HSPECIFIED,5X,8HADJUSTED,7X,6HPT/PSO,7X,6HTT/TSO /
     * (6X,A6,4F13.4))

      RETURN

      ENTRY WRIATP

      REWIND NTAPN
      WRITE (NTAPN) STCFIL,(LIMITS(I),I=1,24)
      WRITE(NTAPN)((IDENT(I),I=1,6),AXIA,RGA,GAMA,MACHA,PSA,TSA,PTA,TTA,
     1  PRPRN,TTE,CHOTST,MAXIT,MAJCTR, (NINNER(I),I=1,16), VELPOT,ICOR,
     & NODENS,RN,NGR,NGZ,(SGR(I),I=1,40),VMG1,VMG2,INRCTR,DREFIN,SG21,
     3  NBCIN(1),NBCIN(2),ACF(1),ACF(2), SSFML,SSEF,SSEANG,SSDF,SSFEND,
     & SSFND1,(DSS(I),I=1,5),(FARFLD(I),I=1,8),
     * RHOC,RHOCSS,RHL,RM,
     *    TREF,MUREF,SBON,(BLB(I),I=1,60),
     5  (ZP(I),I=1,28), (TABLBS(I),I=1,LESTA), (B(I),I=1,NM), (JMS(I),
     6  I=1,NM), (S1(I),I=1,NM), (S2(I),I=1,NM),(ZF(I),I=1,NM), (RF(I),
     7  I=1,NM), (VMF(I),I=1,NM), (W(I),I=1,NU), (X2(I),I=1,NJ),
     & (SLCHN(I),I=1,NJ),TOLRL,MAXSWP,TOLES2,TOLINR,DS1DMP,DS1DP1,
     & (DTOLR2(I),I=1,4),SG1REF,
     & (CRX(I),I=1,6), RHOBAS,RHOAMP,IADM,NTHKY,NTHKY,
     &         (THKX(I),I=1,300),TOLWF)
      NTSAV = NTAPO
      NTAPO = NTAPN
      NTAPN = NTSAV
      RETURN
      END
```

```
*DECK WRIBDY
      SUBROUTINE WRIBDY
*WRIBDY         WRITE OUTPUT FOR EACH BOUNDARY                    *WRIBDY*

C   COMB1
C    STATAB, CHDATA, BDYTAB
C     STATION TABLE
C      INDEX= L=LO,LESTA
C      SCHOKE= STATION CHOKE INDICATOR (ADJWF,BRHS,WRIOUT)
C      MCL    = SHARP CORNER INDICATOR (BLDTBS)
C      MCL    = FIELD INDEX OF CONTROL STREAMLINE (PTMOVE,FLOBAL)
       COMMON /CHDATA/ X1(1),LNEXT(1),MLB(1),MUB(1),PRIM(1),
     1                 TYPELB(1),NAMELB(1),ILB(1),FLB(1),S1LB(1),
     1                 TYPEUB(1),NAMEUB(1),IUB(1),FUB(1),S1UB(1),
     &                 VMB(1),DWDV(1),X2CL(1),SLSWI(1),MCL(1),
     &                 ANGTE(1),PTTE(1),PSTE(1),FGRTE(1),RGTE(1),
     &                 ANGEXP(1),BSQEXP(475)
         DIMENSION     CRVLE(1),ANGLE(1)
         EQUIVALENCE   (SCHOKE,DWDV),(CRVLE,ANGTE),(ANGLE,PTTE)
         INTEGER       PRIM,TYPELB,TYPEUB,SCHOKE(1)
C     BOUNDARY TABLE
C      INDEX- LB=LBDO,LBDE
C      LBNEXT= INCREMENT TO NEXT BOUNDARY
C      LBZ1   = INCREMENT TO THE FIRST BOUNDARY POINT (=0 BEFORE COALLATIO
C      CHNAME= CHANNEL WITH WHICH THE BOUNDARY DATA IS ASSOCIATED
C      UP     = T OR F FOR UPPER OR LOWER BOUNDARY
C      LEDEX = RELATIVE INDEX OF L.E. POINT WHEN LOWER AND UPPER SURFACE
C              CONTOURS ARE CONNECTED
C      BDNAME,LBA,LBB=NAME AND INDEX LIMITS OF SPECIFIC BOUNDARY
C                     DATA WHEN BOUNDARIES ARE COALLATED
        DIMENSION      BDT(1),LBNEXT(1),LBZ1(1),
     1                 CHNAME(1),UP(1),LEDEX(1),
     2                 ZBT(1),RBT(1),ANGBT(42)
       LOGICAL         UP
        INTEGER BDT,CHNAME,BDNAME
        DIMENSION      BDNAME(1),LBA(1),LBB(1)

        DIMENSION      CHNAM(1),LHNEXT(1)
        INTEGER         CHNAM
        EQUIVALENCE    (X1,BDT,CHNAM), (LNEXT,LBNEXT,LHNEXT), (MLB,LBZ1),
     1                 (MUB,CHNAME), (PRIM,UP), (TYPELB,LEDEX),
     2                 (NAMELB,ZBT,BDNAME), (ILB,RBT,LBA), (FLB,ANGBT,
     3                 LBB)
C
       COMMON /BCOMMN/ PROGM(9),FILIN,FILOT
        LOGICAL                  FILIN,FILOT
       COMMON /ADAM01/ NAME(6),ADDRES(6),TITLE(6),IDENT(6)
       COMMON /CEDUMP/  IGODMP
       COMMON /ALLCOM/ MACHA,PSA,TSA,PTA,TTA, AXIA,RGA,GAMA,
     &                 MACHC,PSC,TSC,PTC,TTC, AXIC,RGC,GAMC,
     &                 DAXIT,SCALEA,TTE,CHOTST
        REAL           MACHA,MACHC
        LOGICAL        AXIA,AXIC,CHOTST
       COMMON /CB     / B(300)
       COMMON /CBITS  / BITS,BLANK
       COMMON /CCUBE  / NBC(2),C1(2),C2(2),FEND(2)
       COMMON /CCURV  / CURV(300)
       COMMON /CFB    / L,MA,MB,PLB,PUB,WF,CHOKE,SUBSON, NK,PLBC,PUBC,
     &                 XCHOKE, TAREA,VMBC, WRQST,WCALC, QV(8),QVP(8),
     &                 JSUM,VMLBSQ
        INTEGER        XCHOKE
        LOGICAL                        CHOKE,SUBSON
```

```
      COMMON /CGRAV / CG
      COMMON /CIDEX / M,J,MU,MD,ISTAG
      COMMON /CLINES/ LINES,OMITFK,PTITLE(6)
      COMMON /CM    / JMS(300)
      COMMON /CDS2  / MACHM(300)
       REAL           MACHM
      COMMON / CNORM / RHL,RM,AHL,ARM
      COMMON /CPHI1 / PHI1(300)
      COMMON /CPI   / PI,TWOPI,PIO2,PIO4,TODEG,TORAD
      COMMON /CPRPRN/ PRPRN
       INTEGER        PRPRN
      COMMON /CPSM  / PSM(300)
      COMMON /CS2   / PTM(300)
      COMMON /CR    / R(300)
      COMMON /CS1   / S1(300)
      COMMON /CTHICK/ NTHKX
      COMMON /CRHS  / TTM(300)
      COMMON /CVM   / VM(300)
      COMMON /CZ    / Z(300)
      COMMON /ERASE2/ XI1(100),SW(100),ZW(100),RW(100),ANGW(100),
     *                CURVW(100),VE(100),MACH(100),PSQPO(100),CP(100),
     *         PSQPT(100),PTQPTO(100), TT(100),AW(100),SPDA(100)
      DIMENSION DSTR(100),DDSTR(100)
      EQUIVALENCE (DSTR,ANGW),(DDSTR,CURVW)
C  NEW VARIABLES FOR NASA VERSION ONLY--PSQPT AND PTQPTO
      COMMON /ERASE3/ AUAN(100),CDPI(100),PSMPO(100),LAMW(100)
       REAL           MACH
       DIMENSION      XW(1),YW(1)
       EQUIVALENCE    (XW,ZW),(YW,RW)
      COMMON /CFRFLD/ FSAV(300), STXU(128),STXD(128),STYU(128),STYD(128)
      COMMON /IXORIG/ LHO,LHE, LBDO,LBDE, LTO,LTE, LWO,LWE, LFO,LFE,
     &                LO,LESTA,LSO,LSE,LDUM(6),
     &                MD,NM, NJ,NFCOLS, MAXNJ,MAXOL,MAXNM,MAXLE,
     &                LEO,LEE, LRO,LRE,LRD
      COMMON /SLTAB / W(128),X2(128),SLCHN(128)
       INTEGER SLCHN
      COMMON /CHNFPT/ ICHN(10),WTFS(10),WTFA(10),WPTO(10),WTTO(10), IC

      COMMON /BLBDY / BLB(60)
      DIMENSION IBLB(60)
      EQUIVALENCE (IBLB,BLB)
      COMMON /BLDTA / BNAME,LOWER,IBTYPE,N1,NI,CAPX1
      INTEGER         BNAME
      COMMON /TETAB / ITE,XIT2(16),TEANG(16),DSTTE(16),DDSTTE(16)
     *               RTE(16),ZTE(16),LWER(16)
       LOGICAL        LWER
      COMMON /SABCHN/ CHNSAB
       INTEGER        CHNSAB


       INTEGER HLE,HTE,ASL,BDY,TSL,CHNN,CHN,XK5SV,XKEYB,BLANK

      LOGICAL         DOUBLE,LOWER,UPPER
      DIMENSION  LOWUP(2),LCDPI(2)
      DATA LOWUP/5HLOWER,5HUPPER/
      DATA HLE,HTE/2HLE,2HTE/, ASL,BDY,TSL/3HASL,3HBDY,3HTSL/

      ITE    = 0
      IGODMP= 2
      NTRY   = 1
C     DEFINE REFERENCE DYNAMIC PRESSURE, ETC
```

```
      QO     = 0.
      IF(MACHA.LE..1) GO TO 95
      IF(GAMA.NE.0.) GO TO 92
      QO      = (RGA*TSA)/(PSA*MACHA*MACHA)
      GO TO 95
   92 QO      = 2./(GAMA*PSA*MACHA*MACHA)
C
C     BEGIN LOOP THROUGH CHANNELS
   95 LINES = 64
      IUP   = 4
      NCHN  = 1
      J2    = 1
  105 CHNN  = SLCHN(J2)
      LOWER = .TRUE.
      I     = 0
  107 I     = I+1
      IF(CHNN.NE.ICHN(I) .AND. I.LT.IC) GO TO 107
      QPTO  = 1./WPTO(I)
      QTTO  = 1./WTTO(I)
      GO TO 122
  110 J2    = J2+1
      IF(J2.EQ.NJ .OR. SLCHN(J2+1).NE.CHNN) GO TO 120
      GO TO 110
  120 LOWER = .FALSE.
C
C     BUILD I-SUBSCRIPTED ARRAYS
  122 M      = MBEGIN(J2)
      L      = 0
      SPDASV= 0.
      XK5SV = BDY
  123 I      = 1
      SWORG = S1(M)
      PTO   = PTM(M)
      TTO   = TTM(M)
      TTQTTO= TTM(M)*QTTO
  124 DOUBLE= .FALSE.
  125 CALL GETIX
      CALL STANO(M,L,URPER)
      XI1(I)=X1(L)
      SW(I)  = S1(M)-SWORG
      ZW(I) = Z(M)
      RW(I) = R(M)
      ANGW(I)=PHI1(M)*TODEG
      PS    = PSM(M)
      IF (XK5SV.NE.TSL) GO TO 126
      ISIGN = 1
      IF (LOWER) ISIGN=-1
      MTSL  = M+ISIGN
      IF ( (ABS(R(M)-R(MTSL)).GT.1.E-5) .OR. (ABS(Z(M)-Z(MTSL))
     &  .GT.1.E-5)) GO TO 126
      ANGW(I)= .5*(PHI1(M)+PHI1(MTSL))*TODEG
  126 CURVW(I)= CURV(M)
      MACH(I)= MACHM(M)
      VE(I)=VM(M)
C
C        T.E. SINGULARITY
         IF(ISTAG.NE.2 .OR. (TYPELB(L).NE.KTE.AND.TYPEUB(L).NE.KTE) .OR.
     *   BSQEXP(L).EQ.BITS) GO TO 138
         IF(I.NE.1.AND.BSQEXP(L).GE.0.) GO TO 132
         VE(I) = 0.
         IF(FGRTE(L).EQ.0.) GO TO 132
         MACH(I)=SQRT(1.+BSQEXP(L))
```

```
      TSX    = TTM(M)/(1.+.5/FGRTE(L)*(1.+BSQEXP(L)))
        VE(I) = MACH(I)*SQRT((1./FGRTE(L)+1.)*RGTE(L)*TSX)
      PS     = PTM(M)*(TSX/TTM(M))**(FGRTE(L)+1.)
C       DOWNSTREAM SIDE ONLY
  132   IF(I-1) 134,136,134
  134   ANGW(I)=ANGTE(L)*TODEG
        GO TO 138
C       UPSTREAM SIDE ONLY
  136   ANGW(I)=ANGEXP(L)*TODEG
        CURVW(I)=BITS
  138 AW(I) = RW(I)
      PSQPT(I)=PS/PTM(M)
      PTQPTO(I)=PTM(M)*QPTO
      IF( AXIA ) AW(I)=PI*RW(I)*RW(I)
      PSQPO(I)=PS/PSA
      PSMPO(I)=PS-PSA
      CP(I) = PSMPO(I)*QO
      IF(LOWER) PSMPO(I)=-PSMPO(I)
      NI     = I
      I      = I+1
      IF(NI.EQ.1) GO TO 160

C      CHECK FOR LEADING EDGE POINT
      IF(ISTAG.NE.1) GO TO 140
      IF(TYPELB(L).EQ.HLE .OR. TYPEUB(L).EQ.HLE) GO TO 170
C      ISTAG=1
      IF(DOUBLE) GO TO 160
      DOUBLE= .TRUE.
      GO TO 125

C      CHECK FOR TRAILING EDGE POINT
  140 IF(ISTAG.NE.2) GO TO 160
C      ISTAG=2
      IF(TYPELB(L).EQ.HTE .OR. TYPEUB(L).EQ.HTE) GO TO 190

C      ISTAG=0,3 OR DOUBLE=T
  160 M      = MD
      IF(M.GT.0) GO TO 124
      GO TO 180

C    APPROACH STREAMLINE
  170 XKEYB   =ASL
      GO TO 200
C    BODY SURFACE
  180 XKEYB   =XK5SV
      GO TO 200
C    TRAILING STREAMLINE
  190 XKEYB   =XK5SV
      XK5SV = TSL

  200 IF(XKEYB   .EQ.TSL) GO TO 220
      IF(.NOT.LOWER) GO TO 220
      LB     = LBF(NAMELB(L))
      IF(LEDEX(LB).EQ.0) GO TO 220
C      LOOP TO FIND BOUNDARY NAME OF UPPER SIDE OF L.E.
      LBX    = LB
  214 IF(LBA(LBX).GE.LEDEX(LB)) GO TO 220
      LBX    = LBX+3
      IF(LBX.LT.(LB+LBZ1(LB))) GO TO 214
      CALL ERRORS
C    PROJECTED AREA
```

```
  220 CALL SETM(1,1., LAMW,NI)
      DATA LCDPI/4HCDPI,4HLAMW/
      LLCDPI= LCDPI(2)
      IF(NTHKX.LE.1) GO TO 224
      CALL LFIT2D(ZW,RW,LAMW,NI)
      DO 222 I=2,NI
      COEF   = .5*(LAMW(I)+LAMW(I-1))
      IF(AXIA) COEF=PI*(RW(I)*LAMW(I)+RW(I-1)*LAMW(I-1))
  222 AW(I) = AW(I-1)+COEF*(RW(I)-RW(I-1))
C     PRESSURE DRAG
  224 SPDA(1)=SPDASV
      CALL LSUM(AW,PSHRO,NI, SPDA)
      SPDASV= SPDA(NI)
C   DRAG COEFFICIENT
      ARM     = RM
      IF ( AXIA ) ARM = PI*RM*RM
      DO 225 I=1,NI
      AW(I) = (ARM-AW(I))/ARM
  225 CDPI(I) = -SPDA(I)*QO/ARM
      ADDG   = -SPDASV*QO/ARM
      LLCDPI= LCDPI(1)
  230 IF(PRPRN.EQ.(-2).AND.XKEYB.NE.BDY) GO TO 308
      LINES = 64
      CALL FHEAD(NI+6)
  308 KUP    = 2
      IF(LOWER) KUP=1
      CHN    = SLCHN(J2)
      XI2    = X2(J2)
      SWORG = 0.
      CHNSAB = CHN
      WRITE (6,1200) LOWUP(KUP),CHN,XI2,LLCDPI,
     & (XI1(I),SW(I),ZW(I),RW(I),
     * ANGW(I),CURVW(I),PSQPO(I),CP(I),PSQPT(I),MACH(I),CDPI(I),AW(I),
     * PTQPTO(I),I=1,NI)
 1200 FORMAT (/2X,A6,17H BOUNDARY TO CHN=,A6,31H,   STREAMLINE COORDINAT
     *E, XI2=,F7.3,1H,//   5X,3HXI1,6X,3HS1W,7X,5HXW,ZW,6X,5HYW,RW,5X,
     * 4HANGW,5X,5HCURVW,5X,5HPS/PO,5X,2HCP,4X,5HPS/PT,4X,4HMACH,5X,
     & A4,14H (AMAX-A)/AMAX,8H  PT/PTO  / (2X,2F8.3,F12.5,F11.5,
     * F8.3,F11.5,2F9.3,F7.3,2F9.4,F14.3,F8.3,I6)

      WRITE (6,1210) TTQTTO
 1210 FORMAT (/6X,8HTT/TTO =,F9.3)
      IF ( XKEYB.EQ.ASL ) WRITE (6,1220) ADDG
 1220 FORMAT (/6X,15HADDITIVE DRAG =,F9.4)
      IF( XKEYB.EQ.ASL .OR. XKEYB.EQ.TSL ) GO TO 309
C****************************  BOUNDARY LAYER  ************************
      NAME  = NAMELB(L)
      IF( .NOT.LOWER ) NAME=NAMEUB(L)
      LBL   = LBDYBL(NAME,LOWER)
      IF( LBL.EQ.0 ) GO TO 309
      CAPX1 = BLB(LBL+2)
      BNAME = IBLB(LBL)
      LSAVE = LESTA
      CALL SAB(NTRY)
      LDTE  = LESTA-LSAVE
      IF( MD.GT.0 ) L=L+LDTE
      NTRY  = 2
C*********************************************************************
      IF(TYPELB(L).EQ.HTE .OR. TYPEUB(L).EQ.HTE) ANGSV=ANGW(NI)*TORAD
  309 IF(TYPELB(L).EQ.HTE .OR. TYPEUB(L).EQ.HTE) GO TO 3090
      GO TO 3091
```

```
 3090 ITE     = ITE+1
      XIT2(ITE)= XI2
      TEANG(ITE)=ANGSV
      IF(LBL.EQ.0) GO TO 3091
      RTE(ITE)= RW(NI)
      ZTE(ITE)= ZW(NI)
      LWER(ITE)= LOWER
      DSTTE(ITE)= DSTR(NI)
      DDSTTE(ITE)=DDSTR(NI)
 3091 IF(MD.GT.0) GO TO 123

C     INTEGRAL MOMENTUM BALANCE ON THE CHANNEL
      IF(.NOT. LOWER) GO TO 310
      PFLB    = SPDASV
      GO TO 110
  310 PFUB    = SPDASV
      FTOT    = STXU(J2)+PFLB+PFUB
      FERR    = FTOT-STXD(J2)
      WRITE (6,1300) CHN,STXU(J2),PFLB,PFUB,FTOT,STXD(J2),FERR
 1300 FORMAT(/1X52HINTEGRAL MOMENTUM BALANCE.  CHN=A6,2X19H(AXIAL FORCES
     * ONLY)/6X31HENTERING MOMENTUM              =F11.4,/6X31HLOWER BOUND
     *ARY PRESSURE FORCE =F11.4,/6X31HUPPER BOUNDARY PRESSURE FORCE =F11
     *.4,/12X12HSUM OF ABOVE=F11.4,/6X31HLEAVING MOMENTUM              =F
     *11.4,/12X25HERROR                    =F11.4,/)

      J2     = J2+1
      IF(J2.LE.NJ) GO TO 105
C  SAVE TE DATA
CREBUILD WAKE TABLE AT ALL TES
      CALL RBWAKE
      IF( NTRY.EQ.2 ) CALL SAB(3)
      RETURN
      END
```

```
*DECK WRIOUT
      SUBROUTINE WRIOUT
*WRIOUT        WRITE STC OUTPUT DATA                              *WRIOUT*

C     STATION TABLE
C      INDEX- L*LO,LESTA
C      SCHOKE= STATION CHOKE INDICATOR (ADJWF,BRNS,WRIOUT)
C      MCL    = SHARP CORNER INDICATOR (BLDTBS)
C      MCL    * FIELD INDEX OF CONTROL STREAMLINE (PTMOVE,FLOBAL)
       COMMON /CHDATA/ X1(1),LNEXT(1),MLB(1),MUB(1),PRIM(1),
     1                 TYPELB(1),NAMELB(1),ILB(1),FLB(1),S1LB(1),
     1                 TYPEUB(1),NAMEUB(1),IUB(1),FUB(1),S1UB(1),
     &                 VMB(1),DWDV(1),X2CL(1),BLSWB(1),MCL(1),
     &                 ANGTE(1),PTTE(1),PSTE(1),FGRTE(1),RGTE(1),
     &                 ANGEXP(1),BSQEXP(475)
        DIMENSION      CRVLE(1),ANGLE(1)
        EQUIVALENCE    (SCHOKE,DWDV),(CRVLE,ANGTE),(ANGLE,PTTE)
        INTEGER        PRIM,TYPELB,TYPEUB,SCHOKE(1)
       DIMENSION  IPRIM(1)
       EQUIVALENCE  (IPRIM,PRIM)

       COMMON /BCOMMN/ PROGM(9),FILIN,FILOT
        LOGICAL                  FILIN,FILOT
       COMMON /ADAM01/ NAME(6),ADDRES(6),TITLE(6),IDENT(6)
       COMMON /ALLCOM/ MACHA,PSA,TSA,PTA,TTA, AXIA,RGA,GAMA,
     &                 MACHC,PSC,TSC,PTC,TTC, AXIC,RGC,GAMC,
     &                 DAXIT,SCALEA,TTE,CHOTST
        REAL           MACHA,MACHC
        LOGICAL        AXIA,AXIC,CHOTST
       COMMON /CBITS / BITS,BLANK
        INTEGER       BLANK
       COMMON /CCURV / CURVF(300)
       COMMON /CFB   / L,MA,MB,RLB,PUB,WF,CHOKE,SUBSON, NK,PLBC,PUBC,
     &                 XCHOKE, TAREA,VMBC, WRQST,WCALC, QV(8),QVP(8),
     &                 JSUM,VMLBSQ
        INTEGER        XCHOKE
        LOGICAL                                 CHOKE,SUBSON
       COMMON /CGRAV / CG
       COMMON /CIDEX / M,J,MU,MD,ISTAG
       COMMON /CLINES/ LINES,OMITFK,PTITLE(6)
       COMMON /CDS2  / MACHM(300)
        REAL           MACHM
       COMMON /CPHI1 / PHI1(300)
       COMMON /CP1   / PI,TWOPI,PIO2,PIO4,TODEG,TORAD
       COMMON /CPRPRN/ PRPRN
        INTEGER        PRPRN
       COMMON /CPSM  / PSM(300)
       COMMON /CS2   / PTM(300)
       COMMON /CR    / RF(300)
       COMMON /CSS   / SSFML,SSEF,SSEANG,SSDF,SSFEND,SSFND1,
     &                 DSS(4),TSIC,RHOO,RHOCSS
        INTEGER        SSFML
        LOGICAL             SSEF,       SSDF
       COMMON /CRHS  / TTM(300)
       COMMON /CVM   / VMF(300)
       COMMON /CZ    / ZF(300)
       COMMON /ERASE2/ AREA(96),AREAO(96),DISP(96),PT(96),LAMBDA(96),
     &                 RHO(96),SQRTVV(96),TS(96),TT(96),VMSQ(96),
     &                 VVKQKP(96),
     &                 WQA(96),WSTA(96), RG(96),C2CP(96),FGR(96)
        REAL           LAMBDA
        DIMENSION      FS2(96),SDNORM(96)
```

```
      EQUIVALENCE      (ES2,VVKQKP),(SDNORM,RHO)
      DIMENSION        RCU(96)
      EQUIVALENCE      (RCU,LAMBDA)
     COMMON /ERASE3/ J1(10),K1(10),CHANLS(10),PS(96),MACH(96),FLOW(96)
      DIMENSION        XI2(96),Z(96),R(96),PHI(96),CURV(96),PSQPO(96),
     &                 VM(96),FVX(96),FVY(96),FPX(96),FPY(96),SVX(96),
     &                 SVY(96),SPX(96),SPY(96),STX(96),STY(96)
      EQUIVALENCE      (AREAO,XI2,FVX,STX), (DISR,Z,FVY,STY),
     &                 (SQRTVV,R,FPX), (VMSQ,PHI,FPY), (VVKQKP,CURV,SVX),
     &                 (WQA,PSQPO,SVY), (C2CP,VM,SPX), (FLOW,SPY)
      INTEGER           CHANLS
      REAL             MACH
      DIMENSION        X(1),Y(1)
      EQUIVALENCE      (X,Z),(Y,R)
C  NEW VARIABLES FOR NASA VERSION ONLY
C  CAN USE FGR IF NEEDED
       DIMENSION       PFLOW(96),PSQPT(96),TSQTT(96),CP(96),AQAREF(96),
     *                 RTQPTO(96),FLOWMX(10)
       EQUIVALENCE     (FLOW,PFLOW), (LAMBDA,PSQPT), (TS,TSQTT),
     *                 (RHO,CP) ,(FGR,AQAREF), (RG,PTQPTO)
     COMMON /IXORIG/ LHO,LHE, LBDO,LBDE, LTO,LTE, LWO,LWE, LFO,LFE,
     &                 LO,LESTA,LSO,LSE,LDUM(6),
     &                 MO,NM, NJ,NFCOLS, MAXNJ,MAXOL,MAXNM,MAXLE,
     &                 LEO,LEE, LRO,LRE,LRD
     COMMON /CFRFLD/ FSAV(300), STXU(128),STXD(128),STYU(128),STYD(128)
     COMMON /SLTAB / W(128),X2(128),SLCHN(128)
      INTEGER          SLCHN
     COMMON /CHNFPT/ ICHN(10),WTFS(10),WTFA(10),WPTO(10),WTTO(10), IC

      INTEGER  DBSTAR,SUB,SUPER,BRANCH,ASTERP,TE
      LOGICAL          UPSTRM,DNSTRM
      DATA TE/2HTE/

      IGODMP= 2
      PIINV = 1./PI
      QO    = 0.
      IF(MACHA.LE..1) GO TO 95
      IF(GAMA.NE.0.) GO TO 92
      QO    = (RGA*TSA)/(PSA*MACHA*MACHA)
      GO TO 95
   92 QO    = 2./(GAMA*PSA*MACHA*MACHA)

C    BEGIN LOOP THROUGH STATIONS
   95 CHOKE = .FALSE.
      IFIELD= 0
      JSUM  = 0
      LINES = 64
      LINEA = 0
      L     = LO
  500 PLB   = 0.
      PUB   = 0.
      WF    = 0.

C    SUBSONIC/SUPERSONIC BRANCH SELECTION
      M     = MLB(L)
      CALL GETIX
      JA    = J
      MAA   = M
      M     = MUB(L)
      CALL GETIX
      JB    = J
```

```
      MBB    = M
      IF(JSUM.EQ.0) SUBSON=.TRUE.
      IF(SSEF) SUBSON=.FALSE.
      IF(SCHOKE(L).NE.XCHOKE) GO TO 510
      IF(SSDF) SUBSON=.FALSE.
      JSUM   = JA+256*JB

C     EXECUTE FLOW BALANCE
  510 CALL FLOBAL
      IF(TYPELB(L).EQ.TE .OR. TYPEUB(L).EQ.TE) JSUM=0

C      BRANCH AND ASTERP ARE PRINTOUT INDICATORS
      DATA DBSTAR/2H**/, SUB/3HSUB/, SUPER/5HSUPER/, ICHOKE/5HCHOKE/
  501 ASTERP= BLANK
      IF(PRIM(L)) ASTERP=DBSTAR
      BRANCH= SUPER
      IF(SUBSON) BRANCH=SUB
      IF(SCHOKE(L).EQ.XCHOKE) BRANCH=ICHOKE

      CALL SETM(1,BLANK, CHANLS,10)
      CALL MOVE(2,ZF(MA),Z,NK,1, RF(MA),R,NK,1)
      CALL MOVE(2,CURVF(MA),CURV,NK,1, VMF(MA),VM,NK,1)

      LQ     = 0
      K      = 1
      M      = MA
  520 FLOW(K)=WSTA(K)*CG
      PHI(K)= PHI1(M)*TODEG
      QGAM   = FGR(K)/(1.+FGR(K))
      MACH(K)=VM(K)*SQRT(QGAM/(RG(K)*TS(K)))
      AQAREF(K) = R(K)
      IF ( AXIA ) AQAREF(K) = PI*R(K)*R(K)
      PS(K) = RHO(K)*RG(K)*TS(K)
      PSQPO(K)=PS(K)/PSA
      PSQPT(K)=PS(K)/PT(K)
      TSQTT(K)=TS(K)/TT(K)
C     CP MUST FOLLOW USE OF RG
      CP(K)= (PS(K)-PSA)*QO
      CALL GETIX
      XI2(K)= X2(J)
      IF(SLCHN(J).EQ.CHANLS(LQ)) GO TO 530
      LQ     = LQ+1
      J1(LQ)= J
      K1(LQ)= K
      CHANLS(LQ)=SLCHN(J)
      IF(LQ.GT.1) FLOWMX(LQ-1)=FLOW(K)
      I      = 0
  525 I      = I+1
      IF(SLCHN(J).NE.ICHN(I).AND.I.LT.IC) GO TO 525
      QPTO   = 1./WPTO(I)
  530 PTQPTO(K)=PT(K)*QPTO
      K      = K+1
      M      = M+1
      IF(K.LE.NK) GO TO 520
      J1(LQ+1)=J+1
      K1(LQ+1)=K
      FLOWMX(LQ)=FLOW(K-1)
      LQS    = 0
  533 LQS    = LQS+1
      KB     = K1(LQS)
      KE     = K1(LQS+1)-1
```

```
      FLMX   = 1./FLOWMX(LQS)
      DO 535 K=KB,KE
  535 PFLOW(K)=FLOW(K)*FLMX
      IF(LQS.LT.LQ) GO TO 533

      XI1    = X1(L)
      IF(PRPRN.EQ.(-1)) GO TO 610
      LINEA = 4
      IF(IPRIM(L).NE.0) LINEA=8
      CALL FHEAD(LINEA+NK)
      WRITE (6,1600) XI1,ASTERP,CHANLS,BRANCH,
     1 (XI2(K),PFLOW(K),Z(K),R(K),PHI(K),CURV(K),PSQPO(K),PSQPT(K),
     2 TSQTT(K),CP(K),MACH(K),AQAREF(K),PTQPTO(K),K=1,NK)

 1600 FORMAT (/25H STATION COORDINATE, XI1=,F7.3,A2,13H  CHANNELS-  ,
     110(A6,2X),A5//    5X,13HXI2 STRM FNCT,6X,3HX,Z,8X,3HY,R,8X,3HPHI,
     16X,4HCURV,6X,21HPS/PO    PS/PT    TS/TT,6X,2HCP,6X,4HMACH,6X,
     3 6H  AREA,3X,6HPT/PTO    / (2X,F6.3,F10.5,F12.5,F11.5,F9.3,F11.5,
     4 F9.3,2F8.3,F10.3,F9.4,F11.3,F9.3,7X,),)


  610 IF(IPRIM(L).EQ.0) GO TO 800
      M      = MA
      DO 620 K=1,NK
      COSPHI= COS(PHI1(M))
      SINPHI= SIN(PHI1(M))
      FVX(K)=VM(K)*COSPHI
      FVY(K)=VM(K)*SINPHI
      FPX(K)=(PS(K)-PSA)*COSPHI
      FPY(K)=(PS(K)-PSA)*SINPHI
  620 M      = M+1
      SVX(1)= 0.
      SVY(1)= 0.
      SPX(1)= 0.
      SPY(1)= 0.
      CALL LSPFIT(WSTA,FVX,NK, WSTA,SVX,NK, -1)
      CALL LSPFIT(WSTA,FVY,NK, WSTA,SVY,NK, -1)
      CALL LSPFIT(AREA,FPX,NK, AREA,SPX,NK, -1)
      CALL LSPFIT(AREA,FPY,NK, AREA,SPY,NK, -1)
      DO 630 K=1,NK
      STX(K)= SVX(K)+SPX(K)
  630 STY(K)= SVY(K)+SPY(K)

      KA     = 1
      DO 640 LL=1,LQ
      J      = J1(LL+1)-1
      K      = K1(LL+1)-1
      IF(MU.NE.0) GO TO 635
      STXU(J)=STX(K)-STX(KA)
      STYU(J)=STY(K)-STY(KA)
  635 IF(MD.NE.0) GO TO 640
      STYD(J)=STY(K)-STY(KA)
      STXD(J)=STX(K)-STX(KA)
  640 KA     = K

      IF(PRPRN.EQ.(-1)) GO TO 800
      WRITE (6,1700) SVX(NK),SVY(NK),SPX(NK),SPY(NK),STX(NK),STY(NK)
      LINES = LINES+4
 1700 FORMAT(/6X25HSUM-VM*COS(PHI)*DFLOW    =F10.2,36X,25HSUM-VM*SIN(PHI)
     **DFLOW    =F10.2,/6X25HSUM-(P-PSO)*COS(PHI)*DA =F10.2,36X,25HSUM-(P
     *-PSO)*SIN(PHI)*DA =F10.2,/6X25HTOT AXIAL MOMENTUM FLUX =F10.2,36X,
```

```
     *25HTOTAL Y-MOMENTUM FLUX    =F10.2,)
C    RELOCATE DATA INTO THE M-ARRAYS
 800 CALL MOVE(2, MACH,MACHM(MA),NK,1, PS,PSM(MA),NK,1)
     CALL MOVE(2,PT,PTM(MA),NK,1, TT,TTM(MA),NK,1)
C    FILL IN STAGNATION POINT VALUES
     IF(MLB(L).EQ.MA) GO TO 820
     M      = MLB(L)
     CALL GETIX
     MACHM(M)=0.
     PTM(M)=PTM(MU)
     PSM(M)=PTM(M)
     TTM(M)=TTM(MU)
     VMF(M)= 0.
 820 IF(MUB(L).EQ.MB) GO TO 830
     M      = MUB(L)
     CALL GETIX
     MACHM(M)=0.
     PTM(M)=PTM(MU)
     PSM(M)=PTM(M)
     TTM(M)=TTM(MU)
     VMF(M)= 0.
C    INDEX TO NEXT STATION
 830 L      = L+LNEXT(L)
     IF(L.LT.LESTA) GO TO 500
     RETURN
     END
```

```
*DECK STCXX
      OVERLAY(STC,3,0)
      PROGRAM STCXX
      COMMON /CMAXIT/ MAXIT,MAJCTR,GREFIN,EDUM
      COMMON /SELECT/ LENTRY
      GO TO(10,15,20),LENTRY
   10 CALL REFINE
      GO TO 25
   15 CALL SLC
      CALL PTMOVE
      CALL SPC
      CALL FARFLD
      GO TO 25
   20 CALL ADJSL
   25 RETURN
      END
```

```
*DECK ERRORY
      SUBROUTINE ERROR1
CEDUMPX          EDUMP FOR STC EXECUTE SECTION                        *EDUMPX*

      LOGICAL            IPLOT
      COMMON /CHDATA/ TABLES(1),LNEXT(1),MLB(1),MUB(97)

      COMMON /ALLCOM/ MACHA(20)
      COMMON /CB    / B(300)
      COMMON /CCURV / CURV(300)
      COMMON /CDS2  / DS2(300)
      COMMON /CEDUMP/ IGODMP
      COMMON /CFB   / L,DFB(4),IB,DFB1(2),NK,DFB2(7),NIC,DFB3(17)
      COMMON /CIDEX / M,J,MU,MD,ISTAG
      COMMON /CLINES/ LINES,OMITFK,PTITLE(6)
       LOGICAL                 OMITFK
      COMMON /CM    / JMS(300)
      COMMON /CPHI1 / PHI1(300)
      COMMON /CPLOT1/ PLOT,SAMEXY(13)
       LOGICAL        PLOT
      COMMON /CR    / R(300)
      COMMON /CRHS  / RHS(300)
      COMMON /CS1   / S1(300)
      COMMON /CS2   / S2(300)
      COMMON /CTABPR/ I1TAB
      COMMON /CVM   / VM(300)
      COMMON /CZ    / Z(300)
      COMMON /ERASE2/ AREA(96),AREAO(96),DISP(96),PT(96),LAMBDA(96),
     &                RHO(96),SQRTVV(96),TS(96),TT(96),VMSQ(96),
     &                VVKQKP(96),
     &                WQA(96),WSTA(96), RG(96),C2CP(96),FGR(96)
       REAL           LAMBDA
       DIMENSION      ES2(96),SDNORM(96)
       EQUIVALENCE    (ES2,VVKQKP),(SDNORM,RHO)
       DIMENSION      RCU(96)
       EQUIVALENCE    (RCU,LAMBDA)
      COMMON /IXORIG/ LHO,LHE, LBDO,LBDE, LTO,LTE, LWO,LWE, LFO,LFE,
     &                LO,LESTA,LSO,LSE,LDUM(6),
     &                MO,NM, NJ,NFCOLS, MAXNJ,MAXOL,MAXNM,MAXLE,
     &                LEO,LEE, LRO,LRE,LRD
      COMMON /SLTAB / W(128),X2(128),SLCHN(128)
       INTEGER        SLCHN
      COMMON /BLBDY / IBLB(69)
      IPLOT = PLOT

      LMAX  = 0
  130 WRITE (6,1130)
      CALL TABPRT(3H   ,L,34,8)
      WRITE (6,1150) (J,X2(J),SLCHN(J),W(J),J=1,NJ)
      IF(LMAX) 180,140,180
  140 CALL TABPRT(6HALLCOM,MACHA,20,8)
      CALL TABPRT(5HCIDEX,M,5,5)
      CALL TABPRT(6HIXORIG,LHO,12,2)
      I1TAB = LBDO
      CALL TABPRT(6HBDYTAB,TABLES,LBDE,3)
      I1TAB = LTO
      CALL TABPRT(6HCONVTB,TABLES,LTE,7)
      I1TAB = LWO
      CALL TABPRT(6HWAKETB,TABLES,LWE,2)
      I1TAB = LFO
      CALL TABPRT(6HCADJWF,TABLES,LFE,8)
      I1TAB = LO
```

```
      CALL TABPRT(6HSTATAB,TABLES,LESTA,5)

C  FIELD TABLE DUMP
      L      = LO
      LMAX   = LESTA
  180 OMITFK= .TRUE.
      LINES = 64
  190 MA     = MLB(L)
      MB     = MUB(L)
      CALL FHEAD(MB-MA+2)
      IF (LINES.EQ.(MB-MA+5)) WRITE (6,1200)
      WRITE (6,1202)
      DO 200 M=MA,MB
      CALL GETIX
      WRITE (6,1201) J,M,MU,MD,ISTAG, S1(M),S2(M),Z(M),R(M),PHI1(M),
     &        CURV(M),VM(M),B(M),RHS(M),DS2(M)
  200 CONTINUE
      L      = L+LNEXT(L)
      IF(L.LE.LMAX) GO TO 190
      L      = LMAX

C  ERASE2 DUMP
  300 WRITE (6,1004)
      NIC    = MIN0(NIC,128)
      NK     = MIN0(NK,96)
      GO TO (900,310,330,350,360,370,390), IGODMP
C     FLOBAL
  310 WRITE (6,1000)
      DO 315 I=1,NK
      WRITE (6,1001) (AREA(J),J=I,672,96)
  315 CONTINUE
      WRITE (6,1002)
      DO 320 I=1,NK
      IP     = 672+I
      WRITE (6,1001) (AREA(J),J=IP, 1536,96)
  320 CONTINUE
      GO TO 900

  330 WRITE (6,1003)
      DO 335 I=1,NIC
      WRITE (6,1019) (AREA(J),J=I,768,128)
  335 CONTINUE
      WRITE (6,1005)
      DO 340 I=1,NK
      IP     = 768+I
      WRITE (6,1006) (AREA(J),J= IP,1344,96)
  340 CONTINUE
      GO TO 900

  350 WRITE (6,1007) (AREA(I),I=1152,1183)
      WRITE (6,1009)
      DO 355 I=1,NIC
      WRITE (6,1010) (AREA(J),J=I,1152,128)
  355 CONTINUE
      GO TO 900

C     SLC
  360 WRITE (6,1011) (AREA(I),I=1024,1037)
      WRITE (6,1012)
      DO 365 I=1,IB
  365 WRITE (6,1013) (AREA(J),J=I,1024,128)
```

```
      GO TO 900

  370 WRITE (6,1014)
      DO 375 I=1,NK
      WRITE (6,1001) (AREA(J),J=I,431,48)
  375 CONTINUE
      WRITE (6,1015)
      DO 380 I=1,NK
      WRITE (6,1001) (AREA(J),J=432,863,48)
  380 CONTINUE
      GO TO 900

  390 WRITE (6,1016)
      DO 392 I=1,50
      WRITE (6,1001) AREA(I),AREA(I+128),AREA(I+256),
     &               AREA(I+50),AREA(I+178),AREA(I+306),
     &               AREA(I+100),AREA(I+228),AREA(I+356)
  392 CONTINUE
      WRITE (6,1017) (AREA(I),I=385,896)
      WRITE (6,1018) (AREA(I),I=897,1308)
  900 CONTINUE

      IF( IBLB(1).NE.0 ) CALL TABPRT(5HBLBDY,IBLB,60,3)
      IF( LDE.EQ.0 ) GO TO 1321
      I1TAB = LDO
      CALL TABPRT(5HBLTAB,CHNAM,LDE,3)
 1321 CONTINUE

      LSTOP = 5
      GO TO (999,999) , LSTOP
  999 RETURN

      ENTRY EDUMP1
      LMAX  = L
      IPLOT = .FALSE.
      GO TO 130

 1000 FORMAT (//2X,47HSUBROUTINES ADJWF, BRHS, FLOBAL, WRIBDY, WRIOUT//
     &        11X,4HAREA,8X,5HAREAO,9X,4HDISP,11X,2HPT,7X,6HLAMBDA,10X,
     &        3HRHO,7X,6HSQRTVV)
 1001 FORMAT (2X,9E13.5)
 1002 FORMAT (//13X,2HTS,11X,2HTT,9X,4HVMSQ,7X,6HVVKQKP,10X,3HWQA,9X,
     &        4HWSTA,11X,2HRG,9X,4HC2CP,10X,3HFGR)
 1003 FORMAT (//2X,17HSUBROUTINE PTMOVE// 12X,3HX1L,11X,2HSC,10X,3HSCX,
     &        11X,2HLC,8X,5HLOOPC,10X,3HKCL)
 1004 FORMAT (1H1)
 1005 FORMAT (//11X,4HPHI2,10X,3HDS1,11X,2HZK,11X,2HRK,2X,5HWEZPT,
     &        9X,4HDS1C)
 1006 FORMAT (2X,4E13.5,5X,L2,E13.5)
 1007 FORMAT (//2X,17HSUBROUTINE REFINE//2X,3HIA=,16I7/2X,3HIB=,16I7)
 1009 FORMAT (//13X,2HCR,9X,4HDELS,8X,5HDELVM,2X,4HLSTA,3X,3HMJ2,10X,
     &        3HSGX,10X,3HSGY,10X,3HRAV,10X,3HZAV)
 1010 FORMAT (2X,3E13.5,2I6,4E13.5)
 1011 FORMAT (//2X,14HSUBROUTINE SLC//2X,6HCURSS=,6E13.5/
     &        2X,6HOV    =,8E13.5)
 1012 FORMAT (//13X,2HRB,11X,2HZB,10X,3HANG,8X,5HCURVB,10X,3HS1B,11X,
     &        2HBI,2X,6HJ2DONE,3X,3HMSV)
 1013 FORMAT (2X,6E13.5,2X,2I6)
 1014 FORMAT (//2X,14HSUBROUTINE OLC//13X,2HZK,11X,2HRK,8X,5HWEZPT,
     &        9X,4HPHI2,11X,2HC2,11X,2HSP,10X,3HSPP,10X,3HGSP,9X,4HGSPP)
 1015 FORMAT (//13X,2HDS,10X,3HBET,10X,3HDDS,9X,4HWSTA,9X,4HDISP,11X,
```

```
     &         2HVT,11X,2HPT,9X,4HC2CP,10X,3HFGR)
1016 FORMAT (//2X,26HSUBROUTINES ADDPTB, PLOTR2//11X,4HANGB,11X,2HR3,
     &         11X,2HZB)
1017 FORMAT (/2X,2HRR/(2X,10E13,5),)
1018 FORMAT (/2X,2HZZ/(2X,10E13,5),)
1019 FORMAT (2X,3E13,5,3I13)
1130 FORMAT(//1X,3HCFB,3X,9H1-L,MA,MB,3X,25H4-PLB,PUB,WF,CHOKE,SUBSON,
    &3X,44H9-NK,PLBC,PUBC,XCHOKE,TAREA,VMBC,WRGST,WCALC,
    &5X,32H17-QV(8),QVP(8)    33-JSUM,VMLBSQ)
1150 FORMAT(///1X17HSTREAMLINE TABLE,/17X32HJ       X2             SLCHV
     &     W/(I18,F12,6,6X,A6,F12,6,),)
1200 FORMAT(57X,16HFIELD TABLE DUMP/128H    J     M    MU    MD I     S1
     &     S2            Z              R           PHI1        CURV          V
     &M              B      RHS          DS2)
1201 FORMAT (1X,I3,3I5,I2,2F11.6,2F12.6,F11.6,F12.7,2F11.3,2F10.5)
1202 FORMAT(1H )
     END
```

```
*DECK ADDFPT
      SUBROUTINE ADDFPT(INS,NPTS,JSAV1)
*ADDFPT          ADD FIELD POINTS                                  *ADDFPT*

C     INPUT-
C      INS    = FIELD INDEX OF FIRST POINT TO BE RELOCATED, INDEX OF
C                FIRST NEW POINT
C      NPTS   = NUMBER OF POINTS TO BE INSERTED
C      JSAV1  = INDEX VALUE OF NEW SL ABOVE WHICH THE FIELD J-REFERENCES A
C                TO BE INCREMENTED BY ONE, =999999 IF NO CHANGE IS TO BE MA

      COMMON /IXORIG/ LHO,LHE, LBDO,LBDE, LTO,LTE, LWO,LWE, LFO,LFE,
     *                LO,LESTA,  LDUM(8),
     *                MO,NM, NJ,NFCOLS, MAXNJ,MAXOL,MAXNM,MAXLE,
     *                LEO,LEE, LRO,LRE,LRD
       DIMENSION      LIMITS(24)
       EQUIVALENCE    (LIMITS,LHO)

      COMMON /CB     / B(300)
      COMMON /CM     / JMS(300)
      COMMON /CPHI1  / PHI1(300)
      COMMON /CR     / R(300)
      COMMON /CS1    / S1(300)
      COMMON /CS2    / S2(300)
      COMMON /CVM    / VM(300)
      COMMON /CZ     / Z(300)
      COMMON /CIDEX  / M,J,MU,MD,ISTAG
      M      = INS
      NPT    = NPTS
      JSAV   = JSAV1

C     RELOCATE FIELD POINTS
      NMOVE = M-1-NM
      MTO   = M+NPT
      CALL MOVE(3,Z(M),Z(MTO),NMOVE,D,
     1             R(M),R(MTO),NMOVE,D,
     2             B(M),B(MTO),NMOVE,D)
      CALL MOVE(3,S2(M),S2(MTO),NMOVE,D,
     3             S1(M),S1(MTO),NMOVE,D,
     4             VM(M),VM(MTO),NMOVE,D)
      CALL MOVE(2,JMS(M),JMS(MTO),NMOVE,D,PHI1(M),PHI1(MTO),NMOVE,D)
      NM     = NM+NPT

C     CORRECT THE JMS-CHAIN
      MSAV   = M
      M      = 1
  130 CALL GETIX
      IF(MU-MSAV) 140,135,135
  135 MU     = MU+NPT
  140 IF(MD-MSAV) 150,145,145
  145 MD     = MD+NPT
  150 IF(J-JSAV) 160,155,155
  155 J      = J+1
  160 CALL SAVIX
      M      = M+1
      IF(NM-M) 180,130,130

  180 RETURN
      END
```

```
*DECK ADJSL
      SUBROUTINE ADJSL
*ADJSL-          ADJUST STREAMLINES BY  DS2                         *ADJSL*

C     INPUT-
C      Z,R    = COORDINATES ALONG THE STREAMLINE
C      PHI1   = STREAMLINE ANGLES
C      DS2    = DESIRED POINT MOVEMENT IN THE NORMAL DIRECTION

C     OUTPUT-
C      Z,R    = ADJUSTED COORDINATES

      COMMON /CBITS / BITS,BLANK
      COMMON /CDS2  / DS2(300)
      COMMON /CINNER/ INRCTR,RDUM,NINNER(16),CNVF(16)
      COMMON /CMAXIT/ MAXIT,MAJCTR,GREFIN,EDUM
       LOGICAL                    GREFIN
      COMMON /CPHI1 / PHI1(300)
      COMMON /CR    / R(300)
      COMMON /CZ    / Z(300)
      COMMON /IXORIG/ LHO,LHE, LBDO,LBDE, LTO,LTE, LWO,LWE, LFO,LFE,
     &                LO,LESTA,LSO,LSE,LDUM(6),
     &                MO,NM, NJ,NFCOLS, MAXNJ,MAXOL,MAXNM,MAXLE,
     &                LEO,LEE, LRO,LRE,LRD

      MCTR   = MAX0(1,MAJCTR)
      CNF    = CNVF(MCTR)
      DO 110 M=1,NM
      R(M) = R(M) + DS2(M)*COS(PHI1(M))*CNF
  110 Z(M) = Z(M) - DS2(M)*SIN(PHI1(M))*CNF

      RETURN
      END
```

```
*DECK ADPTSL
      SUBROUTINE ADPTSL(M1,MU1,MD1,J1,NEWSL)
*ADPTSL          ADD A POINT ON THE NEW STREAMLINE                *ADPTSL*
      LOGICAL                                  NEWSL

C     INPUT-
C      M1     = FIELD INDEX OF THE NEW POINT
C      MU1    = UPSTREAM-M FOR NEW POINT
C      MD1    = DOWNSTREAM-M FOR NEW POINT
C      J1     = INDEX OF SL OF THE NEW POINT
C      NEWSL  = T IF A NEW SL, =F OTHERWISE

C     ACTION-
C      IF(NEWSL=T) RELOCATE FOR NEW STREAMLINE IN SL-TABLES
C      RELOCATE FOR NEW POINT IN FIELD TABLES AND CORRECT POINTERS IN JMS

       COMMON /IXORIG/ LHO,LHE, LBDO,LBDE, LTO,LTE, LWO,LWE, LFO,LFE,
     *                 LO,LESTA,  LDUM(8),
     *                 MO,NM, NJ,NFCOLS, MAXNJ,MAXOL,MAXNM,MAXLE,
     *                 LEO,LEE, LRO,LRE,LRD
        DIMENSION      LIMITS(24)
        EQUIVALENCE    (LIMITS,LHO)
       COMMON /SLTAB / W(128),X2(128),SLCHN(128)
        INTEGER SLCHN
       COMMON /CIDEX / M,J,MU,MD,ISTAG


C     ADJUST STREAMLINE TABLE
       JSAV   = 999999
       IF(.NOT.NEWSL) GO TO 100
       J      = J1
       NMOVE  = J-NJ-1
       CALL MOVE(3,W(J),W(J+1),NMOVE,D,
     1            X2(J),X2(J+1),NMOVE,D,
     2            SLCHN(J),SLCHN(J+1),NMOVE,0)
       NJ     = NJ+1
       JSAV   = J

C     RELOCATE FIELD POINTS AND CORRECT JMS-CHAIN
  100 CALL ADDFPT(M1,1,JSAV)

C     INSERT POINTERS IN THE JMS-TABLE
       M      = M1
       MU     = MU1
       MD     = MD1
       J      = J1
       ISTAG  = 0
       CALL SAVIX

C     CORRECT UPSTREAM TO DOWNSTREAM POINTER
       M      = MU
       IF(M) 120,900,120
  120 CALL GETIX
       MD     = M1
       CALL SAVIX
  900 RETURN
       END
```

```
*DECK BDYPTM
      SUBROUTINE BDYPTM(NAME,INTVL, ZD,RD,FD,S1DD,DS1,DS1GMA)
*BDYPTM         BOUNDARY POINT MOVEMENT                              *BDYPTM*

C     INPUT-
C      BDY    = BOUNDARY TABLE
C      NAME   = BOUNDARY NAME
C      INTVL  = INDEX OF INTERVAL OF THE INPUT POINT IN THE BOUNDARY TABLE
C      FD     = FRACTION POSITION OF THE INPUT POINT IN THE INTERVAL
C      S1DD   = ARC DISTANCE FROM THE BEGINING OF THE INPUT INTERVAL
C      DS1    = REQ*D MOVEMENT IN THE CLOCKWISE DIRECTION FROM THE INPUT P

C     OUTPUT-
C      INTVL  = INDEX OF INTERVAL OF THE OUTPUT POINT
C      ZD,RD  = COORDINATES OF THE CALCULATED OUTPUT POINT
C      ANGD   = ANGLE OF OUTPUT POINT
C      CURVD  = CURVATURE OF OUTPUT POINT
C      FD     = FRACTION POSITION IN THE OUTPUT INTERVAL
C      S1DD   = ARC DISTANCE FROM THE BEGINING OF THE OUTPUT INTERVAL
C      DS1GMA= *GET* MINUS *ASK* POINT MOVEMENT DISTANCE

C     BOUNDARY TABLE
C      INDEX- LB=LBDO,LBDE
C      LBNEXT= INCREMENT TO NEXT BOUNDARY
C      LBZ1   = INCREMENT TO THE FIRST BOUNDARY POINT (=0 BEFORE COALLATIO
C      CHNAME= CHANNEL WITH WHICH THE BOUNDARY DATA IS ASSOCIATED
C      UP     = T OR F FOR UPPER OR LOWER BOUNDARY
C      LEDEX = RELATIVE INDEX OF L.E. POINT WHEN LOWER AND UPPER SURFACE
C              CONTOURS ARE CONNECTED
C      BDNAME,LBA,LBB=NAME AND INDEX LIMITS OF SPECIFIC BOUNDARY
C                         DATA WHEN BOUNDARIES ARE COALLATED
      COMMON /CHDATA/ BDT(1),LBNEXT(1),LBZ1(1),
     1                CHNAME(1),UP(1),LEDEX(1),
     2                ZBT(1),RBT(1),ANGBT(42)
       LOGICAL        UP
       INTEGER BDT,CHNAME,BDNAME
       DIMENSION      BDNAME(1),LBA(1),LBB(1)
       EQUIVALENCE    (BDNAME,ZBT), (LBA,RBT), (LBB,ANGBT)
C
      COMMON /CBEAM2/ DR,DZ,YPA,YPB,F,G, DX,YODX,ZM,RM,ANGM,CURVM,S1M,
     1                RZONLY, ANGCHD,SINTVL, YPASQ,YPAB,YPBSQ
       LOGICAL        RZONLY
      COMMON /IXORIG/ LHO,LHE, LBDO,LBDE, LTO,LTE, LWO,LWE, LFO,LFE,
     *                LO,LESTA, LSO,LSE, LDO,LDE, LDUM(4),
     *                MO,NM, NJ,NFCOLS, MAXNJ,MAXOL,MAXNM,MAXLE,
     *                LEO,LEE, LRO,LRE,LRD
       DIMENSION      LIMITS(24)
       EQUIVALENCE    (LIMITS,LHO)
      COMMON /CBDYPT/ ANGD,CURVD
      COMMON /CBITS / BITS,BLANK

      COMMON /CFB   / L,DUMCFB(33)
      COMMON /CLFIT1/ LFOUT
       LOGICAL        LFOUT
      COMMON /CPRINT/ RPDUM(6),PDUM(6)
      COMMON /BLBDY / BLB(60)
      DIMENSION IBLB(60)
      EQUIVALENCE (IBLB,BLB)
      COMMON /REBL  / RESTBL
      LOGICAL         RESTBL
      COMMON /CPI   / PI,DUMPI(5)
      COMMON /CIDEX / M,DUMX(3),ISTAG
```

```
      DIMENSION          BNAME(1),LBLNXT(1),NSEP(2),SWREF(1),
     *                   SIGN(1),SW(1),DSTAR(1),DDSTAR(1)
      INTEGER            BNAME
      EQUIVALENCE        (BNAME,BDT),(LBLNXT,LBNEXT),(NSEP,LBZ1),
     *                   (SWREF,UP),(SIGN,LEDEX),(SW,ZBT),(DSTAR,RBT),
     *                   (DDSTAR,ANGBT)
      LOGICAL  LOWER
      DIMENSION NAMEUB(1)
      EQUIVALENCE (NAMEUB,ANGBT(4))
      DIMENSION SWT(100),DSTART(100),DDSTRT(100)

      F      = FD
      S1D    = S1DD
      IF(F.EQ.0. .OR. F.EQ.1.) F=BITS
      DS1GMA= 0.

C     SEARCH FOR MATCHING BOUNDARY NAME
      LB     = LBF(NAME)
      IF(LB.EQ.0) CALL ERROR1

C     I      = INDEX OF POINT WHICH BEGINS THE INTERVAL
C     SFI    = DISTANCE FROM POINT (I)
C     SFIP1  = DISTANCE FROM POINT (I+1)
      MINI   = LB+LBZ1(LB)
      I      = MINI+3*(INTVL-1)
      MAXI   = LB+LBNEXT(LB)-12
   75 CALL BARC(I)
C         IF *I* IS THE FIRST OF A DOUBLE POINT, BACK UP TO PREV INTERVAL
          IF(SINTVL.NE.0.) GO TO 80
          I      = I-3
          FD     = 1.
          IF(I.LT.MINI) CALL ERROR1
          GO TO 75
   80 IF(FD.EQ.1. .OR. S1D.GT.SINTVL) S1D=SINTVL
      SFI    = DS1+S1D
      SFIP1  = SFI-SINTVL

C     IS THE NEW POINT WITHIN THIS INTERVAL
  100 IF(SFI)    120,114,114
  114 IF(SFIP1) 160,160,140

C     (MOVE COUNTERCLOCKWISE)
  120 IF(I.GT.MINI) GO TO 125
      DS1GMA=-SFI
      SFI    = 0.
      GO TO 230
  125 I      = I-3
      F      = BITS
      SFIP1  = SFI
      CALL BARC(I)
      SFI    = SFIP1+SINTVL
      GO TO 100

C     (MOVE CLOCKWISE)
  140 IF(I.LT.MAXI) GO TO 145
      DS1GMA= -SFIP1
      SFI    = SINTVL
      GO TO 230
  145 I      = I+3
      F      = BITS
      SFI    = SFIP1
```

```
      CALL BARC(I)
      SFIP1 = SFI-SINTVL
      GO TO 100

C     CALCULATE  COORDINATES OF THE NEW POINT (PROPER INTERVAL FOUND)
  160 IF(F.EQ.BITS) GO TO 230
      IF(DS1) 210,220,220
  210 F      = F*SFI/S1D
      GO TO 250
  220 F      = ((SFI-S1D)+(SINTVL-SFI)*F)/(SINTVL-S1D)
      GO TO 250
C     (NEW INTERVAL)
  230 F      = SFI/SINTVL

  250 G      = 1.-F
      RZONLY= .FALSE.
      CALL BFI
      ZD     = ZBT(I)+ZM
      RD     = RBT(I)+RM
      ANGD   = ANGCHD+ANGM
      CURVD  = CURVM
      S1DD   = S1M

      FD     = F
      INTVL  = (I - (LB+LBZ1(LB)))/3 + 1


C************************* BOUNDARY LAYER ADJUSTMENT ********************

      IF( LDE.NE.0 .AND. BDUM(15).NE.0. ) WRITE (6,288) NAME,ZD,RD,
     *                                                  ANGD,CURVD,S1DD
      IF( LDE.EQ.0 ) GO TO 300
      CALL GETIX
      IF( ISTAG.EQ.1 ) GO TO 300
      LOWER = .TRUE.
      IF( NAMEUB(L).EQ.NAME ) LOWER=.FALSE.
      LBL    = LBDYBL(NAME,LOWER)
      IF( LBL.EQ.0 ) GO TO 300
      NAMBL  = IBLB(LBL)
      LFOUT  = .TRUE.

C     SEARCH FOR NAMBL IN BL TABLE

      LD     = LD0
  270 IF(LD.GT.LDE) GO TO 300
      IF( BNAME(LD).EQ.NAMBL ) GO TO 280
      LD     = LBLNXT(LD)
      GO TO 270
  280 NVAL   = (LBLNXT(LD)+LD-6)/3
      LD1    = LD
      DO 281 I=1,NVAL
      SWT(I)= SW(LD1)
      DSTART(I)= DSTAR(LD1)
      DDSTRT(I)= DDSTAR(LD1)
  281 LD1    = LD1+3

C     EVALUATE SWI FOR INTERPOLATION
      SWI    = SIGN(LD)*(BARCS(NAME,1,INTVL)*S1DD-SWREF(LD))
      IF( NSEP(LD).EQ.0 ) GO TO 285
      LDD    = NSEP(LD)
      SWSEP  = SW(LDD)
```

```
      IF(PDUM(17).EQ.0.) WRITE(6,1001) NAMBL,SWSEP
 1001 FORMAT(/6X,21H* * W A R N I N G * *,6X,
     * 26HSEPARATED BL   ,  BOUNDARY=,1X,A6,3X, 3HSW=,F14.6//)

  285 CALL LFIT1(SWT,DSTART,NVAL,SWI,DSTRC,1)
      CALL LFIT1(SWT,DBSTRT,NVAL,SWI,ANGC,1)
      ANGD   = ANGD+SIGN(LD)*ANGC
      CANG   = 0.
      IF( .NOT.LOWBR ) CANG=PI
      ZD     = ZD-SIGN(LD)*DSTRC*SIN(ANGD-CANG)
      RD     = RD+SIGN(LD)*DSTRC*COS(ANGD-CANG)
      IF( PDUM(15).EQ.0. ) GO TO 300
      WRITE (6,289) NAME,NAMBL,ZD,RD,ANGD,CURVD,SLDD,SWI,DSTRC,ANGC
  288 FORMAT(//5X,A6,2X,5E16.8)
  289 FORMAT(//5X,A6,2X,A6,2X,5E16.8/21X,3E16.8)

  300 LFOUT = .FALSE.
      RETURN
      END
```

```
*DECK BF3
      SUBROUTINE BF3(X,Y,ANG,CURV, IA,IB)
*BF3             CENTRAL 3-POINT CURVATURE                        *BF3*
       DIMENSION        X(10),Y(10),ANG(10),CURV(10)
      COMMON /CBEND / NBCB(2),ANGE(2),CURVE(2),FB(2)
      DIMENSION         ANGX(3),CURX(3)
      NBCB(1)=0
      NBCB(2)=0
      IBM2  = IB-2
      ANGX(1)=0.
      IF( IBM2.LT.IA ) RETURN
      DO 110 I=IA,IBM2
      CALL BFAC(X(I),Y(I),ANGX,CURX,3)
      ANG(I+1)=ANGX(2)
  110 CURV(I+1)=CURX(2)
      RETURN
      END
```

```
*DECK BFAC
      SUBROUTINE BFAC(X,Y,ANG,CURV,NK)
*BFAC--         BEAM FIT EVALUATION OF ANGLE, CURVATURE     *BFAC*
      DIMENSION X(10),Y(10),ANG(10),CURV(10)

C     INPUT-
C      X,Y    - COORDINATES
C      ANG    - ANGLE IN RADIANS  (IF MA=1)
C      NK     = LENGTH OF X,Y,ANG,CURV-LISTS

C     OUTPUT-
C      ANG    - ANGLE IN RADIANS
C      CURV   - CURVATURE

      COMMON /CBEAM/   MA,MB,KD,KORDER
      COMMON /ERASE / A(3),B(1),YPB(1),DA(1),ACHD(1),CHD(793)

      CALL BEAM(X,Y,ANG,NK)
      IF (KORDER.NE.0) RETURN

      I      = 1
C     KA     = 1
      KB     = (NK-1)*KD+1
      K      = 1
C     (K=KA,KB-1)
   60 CURV(K)= (4.*B(I)+2.*YPB(I))/(CHD(I)*(1.+1.5*B(I)*B(I)))
   80 I      = I+8
      K      = K+KD
      IF(K-KB) 60,90,90

C     (K=KB)
   90 CURV(K)=(-2.*B(I-8)-4.*YPB(I-8))/(CHD(I-8)*(1.+1.5*YPB(I-8)*YPB(I-
     1          8)))

      RETURN
      END
```

```
*DECK BFACS
      SUBROUTINE BFACS(X,Y,ANG,CURV,S,KA,KB)
*BFACS-         BEAM FIT EVALUATION OF ANGLE, CURVATURE,     *BFACS*
C                                  AND  S
      DIMENSION X(10),Y(10),ANG(10),CURV(10),S(10)

C     INPUT-
C      X,Y    - COORDINATES
C      ANG    - ANGLE IN RADIANS  (IF MA=1)
C      ANG(1)= ESTIMATED ANGLE AT THE FIRST POINT (MA=0)
C      KA,KB - FIRST AND LAST INDEX OF VARIABLES  X,Y,ANG,CURV,E AND S
C      KD     - STORAGE INCREMENT OF  X,Y,ANG,CURV,E, AND S

C     OUTPUT-
C      ANG    - ANGLE IN RADIANS
C      CURV   - CURVATURE
C      S      - ARC LENGTH ALONG THE CURVE,  (L)

      COMMON /CBEAM/   MA,MB,KD,KORDER
      COMMON /ERASE / A(3),B(1),YPB(1),DA(1),ACHD(1),CHD(793)

      NK     = KB

      CALL BFAS(X,Y,ANG,S,KA,KB)
      IF (KORDER.NE.0) RETURN

      I      = 1
      K      = KA
C     (K=KA,KB-1)
   60 CURV(K)= (4.*B(I)+2.*YPB(I))/(CHD(I)*(1.+1.5*B(I)*B(I)))
   80 I      = I+8
      K      = K+KD
      IF(K-NK) 60,90,90

C     (K=KB)
   90 CURV(K)=(-2.*B(I-8)-4.*YPB(I-8))/(CHD(I-8)*(1.+1.5*YPB(I-8)*YPB(I-
     1          8)))

      RETURN
      END
```

```
*DECK BFAS
      SUBROUTINE BFAS(X,Y,ANG,S,KA,KB)
*BFAS--          BEAM FIT EVALUATION OF ANGLE AND S              *BFAS*
      DIMENSION X(10),Y(10),ANG(10),S(10)

C     INPUT-
C      X,Y    - COORDINATES
C      ANG    - ANGLE IN RADIANS  (IF MA=1)
C      ANG(1)= ESTIMATED ANGLE AT THE FIRST POINT (MA=0)
C      KA,KB - FIRST AND LAST INDEX OF VARIABLES  X,Y,ANG,CURV,E AND S
C      KD     - STORAGE INCREMENT OF  X,Y,ANG,CURV,E, AND S
C      KORDER= 0 IF ERROR1 IS TO BE CALLED WHEN PTS ARE OUT OF ORDER
C            = 1 IF RETURN IS TO BE MADE FOR CORRECTIVE ACTION
C            = -1 IF POINT ORDER CHECK IS TO BE SKIPPED

C     OUTPUT-
C      ANG    - ANGLE IN RADIANS
C      S      - ARC LENGTH ALONG THE CURVE,  (L)
C      KORDER= INDEX OF 2ND OF ADJACENT OUT-OF-ORDER PTS (=1 ON ENTRY);

      COMMON /CBEAM / MA,MB,KD,KORDER
      COMMON /ERASE / A(3),B(1),YPB(1),DA(1),ACHD(1),CHD(793)

      NK     = KB

      CALL BEAM(X(KA),Y(KA),ANG(KA),(KB-KA+KD)/KD)
      IF(KORDER.NE.0) GO TO 800

C      (K=KA)
      SK     = S(KA)

C      (K=KA+1,KB)
      I      = 9
      K      = KA+KD
   70 SK     = SK + CHD(I-8)*(1.+(B(I-8)*B(I-8)-.5*B(I-8)*YPB(I-8)+
     1         YPB(I-8)*YPB(I-8))/15.)
      S(K)   = SK
      IF(K-NK) 80,900,900
   80 I      = I+8
      K      = K+KD
      GO TO 70

C     OUT OF ORDER POINTS
  800 KORDER= KA+KORDER-KD

  900 RETURN
      END
```

```
*DECK FARFLD
      SUBROUTINE FARFLD
CFARFLD         COMPUTATION OF VELOCITY ON FAR FIELD BOUNDARY    *FARFLD*

C     STATION TABLE
C      INDEX= L=LO,LESTA
C      SCHOKE= STATION CHOKE INDICATOR (ADJWF,BRHS,WRIOUT)
C      MCL    = SHARP CORNER INDICATOR (BLDTBS)
C      MCL    = FIELD INDEX OF CONTROL STREAMLINE (PTMOVE,FLOBAL)
      COMMON /CHDATA/ X1(1),LNEXT(1),MLB(1),MUB(1),PRIM(1),
     1                TYPELB(1),NAMELB(1),ILB(1),FLB(1),S1LB(1),
     1                TYPEUB(1),NAMEUB(1),IUB(1),FUB(1),S1UB(1),
     &                VMB(1),DWDV(1),X2CL(1),SLSWI(1),MCL(1),
     &                ANGTE(1),PTTE(1),PSTE(1),FGRTE(1),RGTE(1),
     &                ANGEXP(1),BSQEXP(475)
        DIMENSION     CRVLE(1),ANGLE(1)
        EQUIVALENCE   (SCHOKE,DWDV),(CRVLE,ANGTE),(ANGLE,PTTE)
        INTEGER       PRIM,TYPELB,TYPEUB,SCHOKE(1)
C
      COMMON /CR     / R(300)
      COMMON /IXORIG/ LHO,LHE, LBDO,LBDE, LTO,LTE, LWO,LWE, LFO,LFE,
     *                LO,LESTA,  LDUM(8),
     *                MO,NM, NJ,NFCOLS, MAXNJ,MAXOL,MAXNM,MAXLE,
     *                LEO,LEE, LRO,LRE,LRD
       DIMENSION      LIMITS(24)
       EQUIVALENCE    (LIMITS,LHO)
      COMMON /CZ     / Z(300)
      COMMON /CFRFIN/ ATINF,MINF,RFFREF,UINF,ZDN1,ZDN25
      COMMON /CFRFLD/ NFF,MAXFF,ZFF(64),RFF(64),
     *                           ZDN(25),DRDN(25),UDN(25),ZIJ(25,25)
      COMMON /CIDEX / M,J,MU,MD,ISTAG
      COMMON /CPHI1 / PHI1(300)
      COMMON /CPRINT/ PDDUM(16),PRFF,PRFFD,PRFFI,PDDDUM(7)
      COMMON /ERASE / EDUM(711),PHIFF(64),RDN(25)
      COMMON /CISBOT/ DUMIS(30),ADUM(6)
      EQUIVALENCE (R1,RFFREF),(R25,ADUM(2))
      EQUIVALENCE (Z1,ZDN1),(Z25,ZDN25)
C     INPUT***
C      FIELD TABLES R,Z
C      VALUES OF M ON OUTER STREAMLINE
C      Z MATRIX FROM DN SOLUTION OF FAR FIELD
C     OUTPUT***
C      TABLE OF UDN VS ZDN
C     PRFFI=0 USE LFIT1(NORMAL)    PRFFI=1 USE LSPFIT ====*FROM PHI1
C
C     GET R,Z VALUES FROM FIELD TABLES (OUTER STREAMLINE)
C
      L      = LO
    1 M      = MBEGIN(NJ)
      CALL STANO(M,L,UPPER)
      DATA KFAR/6HFARFLD/
      IF( TYPEUB(L).NE.KFAR   ) RETURN
      NF     = 0
    2 NF     = NF+1
      RFF(NF)= R(M)
      ZFF(NF)= Z(M)
      PHIFF(NF)= PHI1(M)
      CALL GETIX
      M      = MD
      IF( M.NE.0 ) GO TO 2
      NFF    = NF
C     PARABOLIC FIT AT END POINTS OF FARFIELD BOUNDARY
```

```
      RA      = RFF(1)
      ZA      = ZFF(1)
      ZASQ    = 1./(Z1-ZA)**2
      A1      = R1+(RA-R1)*Z1**2*ZASQ
      C1      = (RA-R1)*ZASQ
      B1      = -2.*C1*Z1
      RB      = RFF(NFF)
      ZB      = ZFF(NFF)
      ZASQ    = 1./(Z25-ZB)**2
      A25     = R25+(RB-R25)*Z25**2*ZASQ
      C25     = (RB-R25)*ZASQ
      B25     = -2.*C25*Z25
C     LOCATE ENDPOINT INDICES
      DO 200 K=1,25
      IF( ZDN(K).GE.ZA ) GO TO 201
  200 CONTINUE
  201 LU      = K-1
      DO 210 K=1,25
      IF( ZDN(K).GT.ZB ) GO TO 211
  210 CONTINUE
  211 LD      = K
C     INTERPOLATE POINTS IN STC SOLUTION TABLES
      NUM     = LD-LU+1
      IF( PRFF.NE.0. ) CALL LSPFIT(ZFF,RFF,NFF,ZDN(LU+1),RDN(LU+1),
     * NUM,0)
C
C     INTERPOLATE CO-ORDINATE DERIVATIVES ON FAR-FIELD BOUNDARY
C
      IF( PRFFI.NE.0. ) GO TO 4
      CALL LFIT1(ZFF,PHIFF,NFF,ZDN(LU+1),DRDN(LU+1),NUM)
      GO TO 555
    4 CALL LSPFIT(ZFF,PHIFF,NFF,ZDN(LU+1),DRDN(LU+1),NUM,0)
C     FILL END POINTS OF ZDN,DRDN TABLES
  555 DO 556 K=1,LU
      RDN(K)= A1+B1*ZDN(K)+C1*ZDN(K)**2
  556 DRDN(K)= B1+2.*C1*ZDN(K)
      DO 557 K=LD,25
      RDN(K)= A25+B25*ZDN(K)+C25*ZDN(K)**2
  557 DRDN(K)= B25+2.*C25*ZDN(K)

C     ADJUST DERIVATIVE AT ZDN POINTS CLOSEST TO
C     UPSTREAM / DOWNSTREAM STC POINTS

      DZDN    = ZDN(2)-ZDN(1)
      DZA1    = ZA-ZDN(LU)
      DZA2    = ZDN(LU+1)-ZA
      LUC     = LU
      IF( DZA2.GT.DZA1 ) GO TO 558
      LUC     = LU+1
  558 AA      = (ZA-ZDN(LUC))/DZDN
      SP      = B1+2.*C1*ZDN(LUC)
      IF( PRFFI.NE.0. ) GO TO 560
      CALL LFIT1(ZFF,PHIFF,NFF,ZDN(LUC),SB,1)
      GO TO 561
  560 CALL LSPFIT(ZFF,PHIFF,NFF,ZDN(LUC),SB,1,0)
  561 ASSIGN 562 TO LGO
 5622 DRDN(LUC)= SP*(.5+AA)+SB*(.5-AA)
      GO TO LGO , (562,5)
  562 DZA1 = ZB-ZDN(LD)
      DZA2 = ZDN(LD-1)-ZB
      LUC     = LD
```

```
      IF( ABS(DZA2) .GT. ABS(DZA1) ) GO TO 565
      LUC    = LD-1
  563 AA     = (ZDN(LUC)-ZB)/DZDN
      SP     = B25+2.*C25*ZDN(LUC)
      IF( PRFFI.NE.0. ) GO TO 565
      CALL LFIT1(ZFF,PHIFF,NFF,ZDN(LUC),SB,1)
      GO TO 566
  565 CALL LSPFIT(ZFF,RHIFF,NFF,ZDN(LUC),SB,1.0)
  566 ASSIGN 5 TO LGO
      GO TO 5622
C
C    CALCULATE VELOCITIES ON FAR FIELD BOUNDARY
C
    5 DO 10 I=1,25
      SUM    = 0.
      DO 9 J=1,25
    9 SUM    = SUM+ZIJ(I,J)*DRDN(J)
   10 UDN(I)= (1.+SUM)*UINF
      IF( PRFF.EQ.0. ) GO TO 20
      WRITE (6,14)
      WRITE (6,15) (I,ZDN(I),RDN(I),DRDN(I),UDN(I),I=1,25)
   14 FORMAT(//3X,1HI,10X,3HZDN,13X,3HRDN,13X,4HDRDN,12X,3HUDN//)
   15 FORMAT(2X,I2,F17.6,E16.6,1PE17.6,0PF15.6)
C
   20 RETURN
      END
```

```
*DECK INSTA
      SUBROUTINE INSTA(LNEW,LBASE,L3,DOWNB,MA,MB)
*INSTA-                 INSERT A STATION                          *INSTA*
       LOGICAL                          DOWNB

C      INPUT-
C       LNEW  = LOCATION IN STATION-TABLE OF NEW STATION
C       LBASE = LOCATION OF BASE STATION
C       L3    = LOCATION OF DOWNSTREAM (OR UPSTREAM) STATION
C       DOWNB = T IF L3 IS AN UPSTREAM STA, OTHERWISE =F
C       MA,MB = NEW STATION FILED POINT INDEX LIMITS
C       Z,R,PHI1 FIELD VALUES

C      OUTPUT-
C       LNEW  = STATION FOLLOWING NEW STATION

C      STATION TABLE
C       INDEX- L=LO,LESTA
C       SCHOKE= STATION CHOKE INDICATOR (ADJWF,BRWS,WRIOUT)
C       MCL   = SHARP CORNER INDICATOR (BLDTBS)
C       MCL   = FIELD INDEX OF CONTROL STREAMLINE (RTMOVE,FLOBAL)
       COMMON /CHDATA/ X1(1),LNEXT(1),MLB(1),MUB(1),PRIM(1),
     1                 TYPELB(1),NAMELB(1),ILB(1),FLB(1),S1LB(1),
     1                 TYPEUB(1),NAMEUB(1),IUB(1),FUB(1),S1UB(1),
     &                 VMB(1),DWDV(1),X2CL(1),SLSWI(1),MCL(1),
     &                 ANGTE(1),PTTE(1),PSTE(1),FGRTE(1),RGTE(1),
     &                 ANGEXP(1),BSQEXP(475)
        DIMENSION      CRVLE(1),ANGLE(1)
        EQUIVALENCE    (SCHOKE,DWDV),(CRVLE,ANGTE),(ANGLE,PTTE)
        INTEGER        PRIM,TYPELB,TYPEUB,SCHOKE(1)
C
       COMMON /ALLCOM/ MACHA,PSA,TSA,PTA,TTA, AXIA,RGA,GAMA,
     1                 MACHC,PSC,TSC,PTC,TTC, AXIC,RGC,GAMC,
     2                 DAXIT,SCALEA,ITE,CHOTST
        REAL           MACHA(1),MACHC
        LOGICAL        AXIA,AXIC
        LOGICAL        CHOTST
       COMMON /CBEAM2/ DR,DZ,YPA,YPB,F,G, DX,YQDX,ZM,RM,ANGM,CURVM,S1M,
     1                 RZONLY, ANGCHD,SINTVL, YPASQ,YPAB,YPBSQ
        LOGICAL        RZONLY
C       INDEX- M=MO,NM
       COMMON /CZ     / Z(300)
       COMMON /CR     / R(300)
       COMMON /CS2    / S2(300)
       COMMON /CS1    / S1(300)
       COMMON /CPHI1  / PHI1(300)
       COMMON /CM     / JMS(300)
       COMMON /CCURV  / CURV(300)
       COMMON /CB     / B(300)
       COMMON /CIDEX  / M,J,MU,MD,ISTAG
       COMMON /IXORIG/ LHO,LHE, LBDO,LBDE, LTO,LTE, LWO,LWE, LFO,LFE,
     *                 LO,LESTA,  LDUM(8),
     *                 MO,NM, NJ,NFCOLS, MAXNJ,MAXOL,MAXNM,MAXLE,
     *                 LEO,LEE, LRO,LRE,LRD
        DIMENSION      LIMITS(24)
        EQUIVALENCE    (LIMITS,LHO)
       COMMON /SLTAB / W(128),X2(128),SLCHN(128)
        INTEGER SLCHN
       COMMON /CATAN3/ DANG
       COMMON /CBDYPT/ ANGD,CURVD
       COMMON /CBITS / BITS,IBLANK
       COMMON /CMAXIT/ MAXIT,MAJCTR,GREFIN,EDUM
```

```
      COMMON /CPI    / RI,TWOPI,PIO2,PIO4,TODEG,TORAD
      COMMON /CPRINT/ PDUM1(3),PREFIN
      COMMON /CVM    / VM(300)
      COMMON /ERASE / ASL(800)
      COMMON /CFB    / LN,DUMCFB(33)

      INTEGER          BDYNAM,FARFLD,FREE,FIELD,PRES,SOLID
      LOGICAL          UPU,UPD

      DATA FARFLD/6HFARFLD/, FIELD/5HFIELD/, FREE/4HFREE/, PRES/4HPRES/,
     *     SOLID/5HSOLID/

C*** RELOCATE TO MAKE ROOM FOR THE NEW STATION
C    INITIALIZE NEW-STATION VALUE TO THE BASE-STATION VALUES
C     CORRECT THE STA-TABLE INDICIES- L-END, L-BASE, L-THREE, L-UPSTREAM
      LN     = LNEW
      NMOVE  = LN-1 - LESTA
      LB     = LBASE
      CALL MOVE(2, X1(LN),X1(LN+20),NMOVE,D, X1(LB),X1(LN),20,1)
      LESTA  = LESTA+20
      LT     = L3+20
      LU     = LB
      IF(.NOT.DOWNB) GO TO 60
      LB     = LB+20
      LT     = L3
      LU     = L3

C    UPDATE THE POINTERS TO THE FIELD-TABLE
   60 NPTS   = MB-MA+1
      LNEXT(LN)=20
      CALL STTOF1(LN,NPTS)

C*** DEFINE STATION-TABLE VALUES FOR THE NEW STATION
      X1(LN) = .5*(X1(LB)+X1(LT))
      MLB(LN)=MA
      MUB(LN)=MB
      PRIM(LN)=.FALSE.
      X2CL(LN)=BITS

C**  LOWER BOUNDARY STATION-TABLE VALUES
      M      = MA
      CALL GETIX
      MX     = MU
      IF(DOWNB) MX=MD
      LX     = LU
      CALL STANO(MX,LX,UPPER)
      IF(MX-MLB(LX)) 210,220,250
  210 CALL ERROR1

C    LOWER BOUNDARIES OF NEW AND BASE STATIONS ARE ON THE SAME SL
  220 IF(TYPELB(LB).EQ.FIELD) GO TO 250
      IF(TYPELB(LB).EQ.FARFLD) GO TO 260

C    FREE BOUNDARY
      IF(TYPELB(LB).NE.FREE .AND. TYPELB(LT).NE.FREE) GO TO 224
      TYPELB(LN)=FREE
      GO TO 260

C    PRESSURE BOUNDARY
  224 IF(TYPELB(LB).NE.PRES .AND. TYPELB(LT).NE.PRES) GO TO 230
      TYPELB(LN)=PRES
```

```
      GO TO 260

C     SOLID BOUNDARY
  230 TYPELB(LN)=SOLID
      BDYNAM= NAMELB(LX)
      NAMELB(LN)=BDYNAM
      ILB(LN)=ILB(LX)
      FLB(LN)=FLB(LX)
      S1LB(LN)=S1LB(LX)
      LD     = LU
      CALL STANO(MU,LU,UPU)
      CALL STANO(MD,LD,UPD)
      DS1    = .5*(BARCS(BDYNAM,ILB(LU),ILB(LD)) + S1LB(LD)-S1LB(LU))
      IF(UPU.OR.UPD) CALL ERROR1
      IF(DOWNB) DS1=-DS1
      CALL BDYPTM(BDYNAM,ILB(LN),Z(M),R(M),FLB(LN),S1LB(LN),DS1,GMA)
      IF(GMA.NE.0.) CALL ERROR1
      PHI1(M)=ANGD
      B(M)   = .5*(B(MU)+B(MD))
      VM(M)  = .5*(VM(MU)+VM(MD))
      IF(VM(M).EQ.0.) VM(M)=VM(MU+1)
      GO TO 300

C     INFIELD BOUNDARY
  250 TYPELB(LN)=FIELD
      ISTAG =3
      CALL SAVIX
      NAMELB(LN)=IBLANK
  260 ILB(LN)=0
      FLB(LN)=BITS
      S1LB(LN)=BITS

C**  UPPER BOUNDARY STATION-TABLE VALUES
  300 M      = MB
      CALL GETIX
      MX     = MU
      IF(DOWNB) MX=MD
      CALL STANO(MX,LX,UPPER)
      IF(MUB(LX)-MX) 310,320,350
  310 CALL ERROR1

C     UPPER BOUNDARIES OF  NEW  AND  BASE  STATIONS ARE ON THE SAME SL
  320 IF(TYPEUB(LB).EQ.FIELD) GO TO 350
      IF(TYPEUB(LB).EQ.FARFLD) GO TO 360

C     FREE BOUNDARY
      LD     = LU
      CALL STANO(MU,LU,UPU)
      CALL STANO(MD,LD,UPD)
      IF (TYPEUB(LB).NE.FREE .AND. TYPEUB(LD).NE.FREE) GO TO 324
      TYPEUB(LN)=FREE
      GO TO 360

C     PRESSURE BOUNDARY
  324 IF (TYPEUB(LB).NE.PRES .AND. TYPEUB(LD).NE.PRES) GO TO 330
      TYPEUB(LN)=PRES
      GO TO 360

C     SOLID BOUNDARY
  330 TYPEUB(LN)=SOLID
      BDYNAM= NAMEUB(LX)
```

```
      NAMEUB(LN)=BDYNAM
      IUB(LN)=IUB(LX)
      FUB(LN)=FUB(LX)
      S1UB(LN)=S1UB(LX)
      LD     = LU
      CALL STANO(MU,LU,UPU)
      CALL STANO(MD,LD,UPD)
      IF(.NOT.UPU .OR. .NOT.UPD) CALL ERROR1
      DS1    = .5*(BARCS(BDYNAM,IUB(LD),IUB(LU)) + S1UB(LU)-S1UB(LD))
      IF(.NOT.DOWNB) DS1=-DS1
      CALL BDYPTM(BDYNAM,IUB(LN),Z(M),R(M),FUB(LN),S1UB(LN),DS1,GMA)
      IF(GMA.NE.0.) CALL ERROR1
      PHI1(M)= ANGD-PI
      B(M)   = .5*(B(MU)+B(MD))
      VM(M)  = .5*(VM(MU)+VM(MD))
      IF(VM(M).EQ.0.) VM(M)=VM(MU-1)
      GO TO 400

C     INFIELD BOUNDARY
  350 TYPEUB(LN)=FIELD
      ISTAG = 3
      CALL SAVIX
      NAMEUB(LN)=IBLANK
  360 IUB(LN)=0
      FUB(LN)=BITS
      S1UB(LN)=BITS

C     DEFINE THE FIELD POINTS BY CUBIC POLYNOMIAL INTERPOLATION ON SLPS
  400 M      = MA
      RZONLY= .TRUE.
      IF(TYPELB(LN).EQ.SOLID) GO TO 420
  410 CALL GETIX
      DZ     = Z(MD)-Z(MU)
      DR     = R(MD)-R(MU)
      F      = .5
      G      = .5
      ANGCHD= ATAN3(DR,DZ,PHI1(MU))
      YPA    = PHI1(MU)-ANGCHD
      YPB    = PHI1(MD)-ANGCHD
          MSV    = M
          MUSV   = MU
          MDSV   = MD
          M      = MD
          CALL GETIX
          ISTAGD= ISTAG
          MD     = M
          M      = MSV
          MU     = MUSV
          IF(ISTAGD.EQ.1) YPB=-YPA
      RZONLY= .FALSE.
      CALL BFI
      Z(M)   = Z(MU)+ZM
      R(M)   = R(MU)+RM
      PHI1(M)=ANGCHD+ANGM
      VM(M)  = F*VM(MD)+G*VM(MU)
      B(M)   = F*B(MD)+G*B(MU)
C      CHECK FOR POINTS ON A SLIP LINE
      IF(M.EQ.MA .OR. W(J).NE.0.) GO TO 420
      Z(M)   = .5*(Z(M-1)+Z(M))
      M      = M-1
      CALL GETIX
```

```
      M      = MSV
      DZ     = .25*(Z(MUSV)-Z(MU)+Z(MDSV)-Z(MD))
      DR     = .25*(R(MUSV)-R(MU)+R(MDSV)-R(MD))
      Z(M-1)= Z(M)-DZ
      R(M-1)= R(M)-DR
      Z(M)  = Z(M)+DZ
      R(M)  = R(M)+DR
  420 M      = M+1
      IF(M-MB) 410,425,500
  425 IF(TYPEUB(LN).NE.SOLID) GO TO 410

C     CHECK FOR OUT-OF-ORDER POINTS
  500 NORDER= 0
  502 NORDER= NORDER+1
      IF(NORDER.GE.20) CALL ERROR1
      MX1    = 0
      MAP1   = MA+1
      MSV    = MA
      S2(MA)= 0.
      DO 520 M=MAP1,MB
      DR     = R(M)-R(M-1)
      DZ     = Z(M)-Z(M-1)
      S2(M)  = S2(M-1)+SQRT(DR*DR+DZ*DZ)
      CALL GETIX
      IF(W(J).EQ.0.) GO TO 518
      ANG2   = ATAN3(DR,DZ,PHI1(M-1))
      ADANG  = ABS(DANG-PIQ2)
      IF(MX1.NE.0) GO TO 515
      IF(ADANG.GE.PIQ2) MX1=MSV
      MSV    = M-1
  515 IF(ADANG.GE.PIQ2) MX2=M
      GO TO 520
  518 IF((M-1).EQ.MX2) MX2=M
  520 CONTINUE
C     DEFINE THE FIELD PT LOCATIONS BY UPSTREAM AREA DISTRIBUTIONS
      IF(MX1.EQ.0) GO TO 999
      MX1    = MAX0(MX1-NORDER,MA)
      MX2    = MIN0(MX2+NORDER,MB)
      WRITE (6,1550) MX1,MX2
 1550 FORMAT(14H INSTA-MX1,MX2,2I6)
      MX1    = MAX0(MX1-1,MA)
      MX2    = MIN0(MX2+1,MB)
C      ADD UP UPSTREAM AREAS
      M      = MX1
      CALL GETIX
      K      = 1
      ASL(1)= 0.
  562 MUM1   = MU
      M      = M+1
      K      = K+1
      CALL GETIX
      AREA   = SQRT((R(MU)-R(MUM1))*(R(MU)-R(MUM1)) +
     1              (Z(MU)-Z(MUM1))*(Z(MU)-Z(MUM1)))
      IF(AXIA) AREA=(R(MU)+R(MUM1))*AREA
      ASL(K)= ASL(K-1)+AREA
      IF(M.LT.MX2) GO TO 562
      ASLNK  = ASL(K)

C      INTERPOLATE FOR COORDINATES
      DZBA   = Z(MX2)-Z(MX1)
      DRBA   = R(MX2)-R(MX1)
```

```
      DRSQBA= DRBA*(R(MX2)+R(MX1))
      RMASQ  = R(MX1)*R(MX1)
      DVMBA  = VM(MX2)-VM(MX1)
      M      = MX1+1
      K      = 2
  564 F      = ASL(K)/ASLNK
      Z(M)   = Z(MX1)+F*DZBA
      R(M)   = R(MX1)+F*DRBA
      IF(AXIA) R(M)=SQRT(RMASQ+F*DRSQBA)
      VM(M)  = VM(MX1)+F*DVMBA
      M      = M+1
      K      = K+1
      IF(M.LT.MX2) GO TO 564
      GO TO 502

  999 LNEW   = LN+20
      RETURN
      END
```

```
*DECK PTMOVE
      SUBROUTINE PTMOVE
*PTMOVE         POINT MOVEMENT ALONG STREAMLINES          'PTMOVE'

C      POINT MOVEMENT ALONG STREAMLINES TO OBTAIN AN ORTHOGONAL GRID


C     INPUT-
C      R,Z    = COORDINATES
C      PHI1   = ANGLE OF THE STREAMLINES
C      S1     = DISTANCES ALONG THE STREAMLINES
C      DS1DMP= STREAMWISE DAMPING FACTOR (NORM=0.)
C      DS1DP1= ADDITIONAL FACTOR ON DS1DMP FOR 1ST INNER ITR (NORM=.5)
C      ICUB   = NBR REFINMTS TO USE SLC-ANGLES,CURV AT BDY PTS (NORM=0)

C     OUTPUT-
C      S2     = DISTANCES ALONG THE ORTHOGONALS
C      R,Z    = ADJUSTED COORDINATES
C      PHI1   = STREAMLINE ANGLES (ADJUSTED POINTS)
C      S1     = DISTANCES ALONG THE STREAMLINES (ADJUSTED)

C     STATION TABLE
C      INDEX- L=LO,LESTA
C      SCHOKE= STATION CHOKE INDICATOR (ADJWF,BRHS,WRIOUT)
C      MCL    = SHARP CORNER INDICATOR (BLDTBS)
C      MCL    = FIELD INDEX OF CONTROL STREAMLINE (PTMOVE,FLOBAL)
       COMMON /CHDATA/ X1(1),LNEXT(1),MLB(1),MUB(1),PRIM(1),
     1                 TYPELB(1),NAMELB(1),ILB(1),FLB(1),S1LB(1),
     1                 TYPEUB(1),NAMEUB(1),IUB(1),FUB(1),S1UB(1),
     &                 VMB(1),DWDV(1),X2CL(1),SLSWI(1),MCL(1),
     &                 ANGTE(1),PTTE(1),PSTE(1),FGRTE(1),RGTE(1),
     &                 ANGEXP(1),BSQEXP(475)
        DIMENSION      CRVLE(1),ANGLE(1)
        EQUIVALENCE    (SCHOKE,DWDV),(CRVLE,ANGTE),(ANGLE,PTTE)
        INTEGER        PRIM,TYPELB,TYPEUB,SCHOKE(1)

       COMMON /CB     / B(300)
       COMMON /CBDYPT/ ANGD,CURVD
       COMMON /CBEAM2/ DR,DZ,YPA,YPB,F,G, DX,YQDX,ZM,RM,ANGM,CURVM,S1M,
     &                 RZONLY, ANGCHD,SINTVL, YPASQ,YPAB,YPBSQ
        LOGICAL        RZONLY
       COMMON /CBEND / NBCB(2),FB(2)
       COMMON /CBITS / BITS,BLANK
       COMMON /CCURV / CURV(300)
       COMMON /CEDUMP/ IGODMP
       COMMON /CFB    / L,MA,MB,LX,IK,IKDIR,IKA,IKB,
     &                 NK,K,ADS1,XCHOKE,ADS1LB,ADS1UB,GMALB,GMAUB,
     &                 NIC,DFB(17)
       COMMON /CIDEX / M,J,MU,MD,ISTAG
       COMMON /CINNER/ INRCTR,RDUM,NINNER(16),CNVF(16)
       COMMON /CM     / JMS(300)
       COMMON /CMAXIT/ MAXREF,NREFIN,GREFIN,TL
       COMMON /CPHI1 / PHI1(300)
       COMMON /CPI    / PI,TWOPI,PIO2,PIO4,TODEG,TORAD
       COMMON /CPRINT/ CPDUM(6),PDUM(20)
       COMMON /CPTMOV/ VELPOT,ICOB,NODENS,FBASTG
        LOGICAL        VELPOT
       COMMON /CR     / R(300)
       COMMON /CS1    / S1(300)
       COMMON /CS2    / S2(300)
       COMMON /CTOLRL/ DTOLRL(6),DS1DMP,DS1DP1
       COMMON /CVM    / VM(300)
```

```
      COMMON /CZ     / Z(300)
      COMMON /ERASE2/ X1L(128),SC(128),SCX(128),LC(128),LOOPC(128),
     &                KCL(128),
     &                PHI2(96),DS1(96),ZK(96),RK(96),WEZPT(96),DS1C(96)
      DIMENSION       PHI1K(96)
      EQUIVALENCE     (PHI1K,DS1C)
      INTEGER         WEZPT
      COMMON /IXORIG/ LHO,LHE, LBDO,LBDE, LTO,LTE, LWO,LWE, LFO,LFE,
     &                LO,LESTA,LSO,LSE,LDUM(6),
     &                MO,NM, NJ,NFCOLS, MAXNJ,MAXOL,MAXNM,MAXLE,
     &                LEO,LEE, LRO,LRE,LRD
      COMMON /SLTAB / W(128),X2(128),SLCHN(128)
      INTEGER         SLCHN
      COMMON /TROUBL/ ERR,ERRMAJ,INERR,PRERR
      LOGICAL         ERR,ERRMAJ,INERR,PRERR

      INTEGER         FIELD,SOLID,TE

      DATA FIELD/5HFIELD/, NOMCL/6HNO MCL/, SOLID/5HSOLID/, TE/2HTE/
      DATA LE/2HLE/

      IGODMP= 3

C     DS1 RELAXATION FACTOR
      RDS1  = 1.-DS1DMP
      IF(INRCTR.EQ.0) RDS1=RDS1*(1.-DS1DP1)

C     USE PARABOLIC END CONDITIONS ON THE ORTHOGONAL SPLINE FIT
      NBCB(1)=0
      NBCB(2)=0
      FB(1) = 0.
      FB(2) = 0.

C     BUILD ARRAYS OF ARC DISTANCE ALONG CONTROL STREAMLINE
      L      = LO
      LAST   = 0

C     FIRST POINT ON CONTROL STREAMLINE
  210 IF(L.GE.LESTA) GO TO 900
      IC     = 1
      LC(1) = L
      SC(1) = BITS
      XCNTRL= X2CL(L)

  220 X1L(IC)=X1(L)
      IF(SC(1).NE.BITS) GO TO 240
      MA     = MLB(L)
      MB     = MUB(L)
      DO 230 M=MA,MB
      CALL GETIX
      IF(X2(J)-XCNTRL) 230,232,230
  230 CONTINUE
      IF(IC.EQ.1) GO TO 245
      GO TO 243
  232 IF(IC.EQ.1) GO TO 240
C     (THE UPSTREAM OL OF THE REGION IS AT A T.E. AND DOES NOT INCLUDE
C      THE CONTROL STREAMLINE)
      L1     = LC(1)
      MCL(L1)=MU
      SC(1) = S1(MU)

  240 SC(IC)= S1(M)
```

```
      LC(IC)= L
      LOOPC(IC)=2
      MCL(L)= M
      KCL(IC)=M-MLB(L)+1
C      IS CONTROL SL INCLUDED IN THE STATION STREAMLINES
       IF(M.LT.MLB(L)) CALL ERROR1
       IF(M.LE.MUB(L)) GO TO 244
C      CONTROL SL DOES NOT CROSS THIS OL, CHECK FOR FIELD BOUNDARIES
  243  IF(TYPELB(L).NE.FIELD .AND. TYPEUB(L).NE.FIELD) CALL ERROR1
       MCL(L)= NOMCL
       GO TO 245
  244 M        = MD
      CALL GETIX

C     INDEX TO THE NEXT STATION
  245 IF(PRIM(L).EQ.1 .AND. IC.NE.1) GO TO 250
      L        = L+LNEXT(L)
      IC       = IC+1
      GO TO 220

C     LAST POINT ALONG CONTROL STREAMLINE
  250 NIC      = IC
      LOOPC(1)=1
      LOOPC(IC)=1

C     AVERAGE SPACING BETWEEN OL-S
       OLDIST= (SC(IC)-SC(1))/FLOAT(NIC-1)

C     CARRY OUT ORTHOGONALIZATION FOR (1)-PRIMARY AND (2)-ALL OTHER OL'S
       LOOP    = 1
       GO TO 300

C     REDEFINE PRIMARY SC'S
  260 L        = LC(1)
      M        = MCL(L)
      SC(1)    = S1(M)
      L        = LC(NIC)
      M        = MCL(L)
      SC(NIC)=S1(M)

C     LOOP THROUGH STATIONS TO DETERMINE  SCX(IC)      (LOOP=2 ONLY)
C      SCX     = DESIRED POINT MOVEMENT ON THE CONTROL STREAMLINE
      IF(NIC.EQ.2) GO TO 500
      IC       = 1
  265 IC       = IC+1
      L        = LC(IC)
C     PARTIAL OL WITH NO MCL, USE MIDDLE SL TO EVAL. SC(IC)
      IF(MCL(L).NE.NOMCL) GO TO 276
      MSV      = (MLB(L)+MUB(L))/2
      KCL(IC)=MSV-MLB(L)+1
C        SEARCH UPSTREAM
      M        = MSV
      LX       = L
  272 CALL GETIX
      M        = MU
      CALL STANO(M,LX,UPPER)
      IF(MCL(LX).EQ.NOMCL) GO TO 272
      S1UP     = S1(M)
      M        = MCL(LX)
      SCUP     = S1(M)
C        SEARCH DOWNSTREAM
      M        = MSV
```

```
 274 CALL GETIX
     M      = MD
     CALL STANO(M,LX,UPPER)
     IF(MCL(LX).EQ.NOMCL) GO TO 274
     S1UW   = S1(M)
     M      = MCL(LX)
     SCDW   = S1(M)
C       INTERPOLATE
     SC(IC)= SCUP + (SCDW-SCUP)*(S1(MSV)-S1UP)/(S1DW-S1UP)

 276 IF(LOOPC(IC).NE.1) GO TO 265
 278 X1A    = X1L(1)
     X1B    = X1L(NIC)
     SCA    = SC(1)/(X1B-X1A)
     SCB    = SC(NIC)/(X1B-X1A)
     DO 280 IC=1,NIC
 280 SCX(IC)=(X1L(IC)-X1A)*SCB+(X1B-X1L(IC))*SCA - SC(IC)
C,,   END LOOP TO EVAL  SCX(IC)

C****CALCULATE ANGLE AND ARC LENGTH ALONG THE ORTHOGONALS
 300 IC     = 1
 302 IF(LOOP.NE.LOOPC(IC)) GO TO 450
     L      = LC(IC)
C    LAST   = LAST STATION OF PREVIOUS REGION (ALREADY ORTHOGONALIZED)
     IF(L.EQ.LAST) GO TO 450
     RZONLY= .FALSE.
     MA     = MLB(L)
     MB     = MUB(L)

C    BOUNDARY SURFACE ANGLES,  PHI1(MA) & PHI1(MB)
     IF(ICOB-NREFIN) 303,306,306
 303 IF(TYPELB(L).NE.SOLID) GO TO 304
     CALL BDYPTM(NAMELB(L),ILB(L),Z(MA),R(MA),FLB(L),S1LB(L),0.,GMALB)
     PHI1(MA)=ANGD
 304 IF(TYPEUB(L).NE.SOLID) GO TO 306
     CALL BDYPTM(NAMEUB(L),IUB(L),Z(MB),R(MB),FUB(L),S1UB(L),0.,GMAUB)
     PHI1(MB)=ANGD-PI

C    RELOCATE Z,R TO ALLOW FOR DOUBLE SL-S
 306 NK     = MB-MA+1
     M      = MA
     K      = 1
 308 ZK(K)  = Z(M)
     RK(K)  = R(M)
     PHI1K(K)=PHI1(M)
     WEZPT(K)=0
     CALL GETIX
     IF(W(J).NE.0. .OR. K.EQ.1) GO TO 310
     WEZPT(K-1)=1
     ZK(K-1)=.5*(ZK(K)+ZK(K-1))
     RK(K-1)=.5*(RK(K)+RK(K-1))
     PHI1K(K-1)=.5*(PHI1K(K)+PHI1K(K-1))
     GO TO 312
 310 K      = K+1
 312 M      = M+1
     IF(M.LE.MB) GO TO 308
     NKX    = K-1

*    BEAM FIT TO GET PHI2 & S2
     PHI2(1)=PHI1K(1)+PIO2
     S2(MA)= 0.
     CALL BFAS(ZK,RK,PHI2,S2(MA), 1,NKX)
```

```
C     COMPUTE DEVIATION FROM  90 DEG  BETWEEN STREAMLINE AND 'ORTHOGONAL'
C     INTEGRATE TO OBTAIN PT MOVEMENT ALONG SL'S REQ'D FOR ORTHOGONALITY
      PHI2(1)=PHI2(1)-(PHI1K(1)+PIQ2)
      DS1(1)= 0.
      K     = 2
      M     = MA+1
 314  PHI2(K)=PHI2(K)-(PHI1K(K)+PIQ2)
      DS1(K)= DS1(K-1)+.5*(PHI2(K)+PHI2(K-1))*(S2(M)-S2(M-1))
      K     = K+1
      M     = M+1
      IF(K-NKX) 314,314,315

C     LOCATE BACK  PHI2  AND  S2  IF DOUBLE SL OCCURED
 315  IF(NKX.EQ.NK) GO TO 322
      K     = NKX
 316  IF(WEZPT(K)) 317,318,317
 317  M     = K-1+MA
      NMOVE = -(NKX-K+1)
      CALL MOVE(3, DS1(K),DS1(K+1),NMOVE,1, S2(M),S2(M+1),NMOVE,1,
     &            WEZPT(K),WEZPT(K+1),NMOVE,1)
      NKX   = NKX+1
      WEZPT(K)=0
  318 K     = K-1
      IF(K.GE.1) GO TO 316
      IF(NKX.NE.NK) CALL ERROR1

C     (BOUNDARY S1-TOLERANCE)
  322 TOLS1 = .02*S2(MB)/FLOAT(NK)

C     CORRECT POSSIBLE JOG AT DOUBLE STREAMLINE
      DO 328 K=2,NK
      IF(WEZPT(K)) 326,328,326
 326  M=MA+K-1
      DZ    = Z(M)-Z(M-1)
      DR    = R(M)-R(M-1)
      PHI1AV= .5*(PHI1(M)+PHI1(M-1))
      CS    = COS(PHI1AV)
      SN    = SIN(PHI1AV)
      S2MMM1= DR*CS-DZ*SN
      IF(S2MMM1.GT.0.) GO TO 327
      Z(M-1)= .5*(Z(M)+Z(M-1))
      R(M-1)= .5*(R(M)+R(M-1))
      Z(M)  = Z(M-1)
      R(M)  = R(M-1)
      S2(M) = S2(M-1)
      PHI1(M)=PHI1AV
      PHI1(M-1)=PHI1AV
      DS1(K)= DS1(K-1)
      GO TO 328
 327  S1JOG=(DZ*CS+DR*SN)/2.
      DS1(K-1)=DS1(K-1)+S1JOG
      DS1(K)=DS1(K)-S1JOG
      S2(M-1)=S2(M-1) - .5*S2MMM1
      S2(M) = S2(M-1) + S2MMM1
 328  CONTINUE

C     EVALUATE  ADS1  FOR PROPER SPACING BETWEEN OL-S
 329  IF(LOOP-2) 3295,3302,3302
 3295 IF(PRIM(L).EQ.0) CALL ERROR1
C      PRIMARY OL-S
      KK    = MCL(L)-MA+1
```

```
      IF(TYPELB(L).EQ.LE) KK=1
      IF(TYPEUB(L).EQ.LE) KK=NK
      ADS1   = -DS1(KK)
      GO TO 3303
C      REGULAR OL-S
 3302 KK     = KCL(IC)
      ADS1   = SCX(IC)-DS1(KK)

C     CHECK TO SEE IF MAGNITUDE OF  DS1  IS REASONABLE
 3303 IF(ABS(DS1(NK)).LT.(.5*(S2(MB)+OLDIST))) GO TO 3304
      WRITE (6,1330) X1(L),L
      IF(NREFIN.GE.2) CALL ERROR1

C     CORRECTION DUE TO STREAMLINE CURVATURES & DAMPING
 3304 DS1(1)=DS1(1)+ADS1
      DS1C(1)=0.
      K      = 2
      M      = MA+1
 3306 DS1(K)= DS1(K)+ADS1
      DS1C(K)=DS1C(K-1)+.5*(CURV(M)*DS1(K)+CURV(M-1)*DS1(K-1))
     &          *(S2(M)-S2(M-1))
      K      = K+1
      M      = M+1
      IF(MB-M) 3310,3306,3306
 3310 ADS1 = -DS1C(KK)
      K      = 1
 3312 DS1C(K)=DS1C(K)+ADS1
      IF(DS1(K)*DS1C(K)) 3313,3314,3314
 3313 DS1(K)= DS1(K)/(1.-DS1C(K)/DS1(K))
 3314 DS1(K)= DS1(K)*RDS1
      K      = K+1
      IF(NK-K) 3316,3312,3312

C     LOWER AND UPPER BOUNDARY POINT MOVEMENT
 3316 ADS1   = 0.
      ADS1LB= DS1(1)
      ADS1UB= -DS1(NK)

C     MOVE THE LOWER BOUNDARY POINT
      K      = 1
 332  GMALB  = 0.
      GMAUB  = 0.
      M      = MLB(L)
      CALL GETIX
      IF(TYPELB(L).NE.TE) GO TO 3321
      ADS1LB= 0.
      GO TO 3324
 3321 IF(ISTAG.EQ.1) GO TO 333
      IF(NODENS-NREFIN) 3323,3322,3322
 3322 IF(TYPELB(L).EQ.FARFLD .OR. TYPELB(L).EQ.FREE .OR.
     & TYPELB(L).EQ.PRES) GO TO 3324
 3323 IF(TYPELB(L).NE.SOLID) GO TO 334
 3324 MA     = MLB(L)
      IF(ADS1LB) 3325,3325,3326
 3325 IF(MU.NE.0) ADS1LB=AMAX1(ADS1LB,.5*(S1(MU)-S1(M)))
      GO TO 3327
 3326 IF(MD.NE.0) ADS1LB=AMIN1(ADS1LB,.5*(S1(MD)-S1(M)))
 3327 CALL BDYPTM(NAMELB(L),ILB(L),Z(MA),R(MA),FLB(L),S1LB(L),
     &               ADS1LB,GMALB)
      S1(MA)= S1(MA)+ADS1LB+GMALB
      IF(TYPELB(L).EQ.TE) ANGTE(L)=ANGD
C      JUMP OVER RELOCATION OF ANGLE/CRUVATURE IF  ICOB (INTERIOR POINT
```

```
C        CURVATURE FORMULA ON BOUNDARY)  IS LESS THAN OR EQUAL TO  NREFIN.
         IF(NREFIN.LE.ICOB .OR. (ISTAG.EQ.2.AND.B(MA).GT.0.)) GO TO 333
         PHI1(MA)=ANGD
         CURV(MA)=CURVD
   333   MA      = MA+1
         K       = 2

C       MOVE THE UPPER BOUNDARY POINT
   334   M       =MUB(L)
         CALL GETIX
         IF(TYPEUB(L).NE.TE) GO TO 335
         ADS1UB= 0.
         GO TO 3352
   335   IF(ISTAG.EQ.1) GO TO 336
         IF(NODENS-NREFIN) 3351,3350,3350
  3350   IF(TYPEUB(L).EQ.FARFLD .OR. TYPEUB(L).EQ.FREE .OR.
       & TYPEUB(L).EQ.PRES) GO TO 3352
  3351   IF(TYPEUB(L).NE.SOLID) GO TO 338
  3352   MB      = MUB(L)
         IF(ADS1UB) 3355,3355,3356
  3355   IF(MD.NE.0) ADS1UB=AMAX1(ADS1UB,.5*(S1(M)-S1(MD)))
         GO TO 3357
  3356   IF(MU.NE.0) ADS1UB=AMIN1(ADS1UB,.5*(S1(M)-S1(MU)))
  3357   CALL BDYPTM(NAMEUB(L),IUB(L),Z(MB),R(MB),FUB(L),S1UB(L),
       &                 ADS1UB,GMAUB)
         S1(MB)= S1(MB)-ADS1UB*GMAUB
         IF(TYPEUB(L).EQ.TE) ANGTE(L)=ANGD-PI
         IF(NREFIN.LE.ICOB .OR. (ISTAG.EQ.2.AND.B(MB).GT.0.)) GO TO 336
         PHI1(MB)=ANGD-PI
         CURV(MB)=-CURVD
   336   MB      = MB-1

C       CHECK FOR NON PRIM STATIONS EXTENDING BEYOUND THE ENDS OF THE BOUND
   338   IF(PRIM(L).EQ.1) GO TO 340
         IF((GMALB+GMAUB).NE.0.) CALL ERROR1
         GO TO 348

C       PRIM STATIONS. IF EITHER 'GET MINUS ASK' VALUE IS LARGE
C        CORRECT OTHER BOUNDARY.
   340   IF(IC.NE.1) GO TO 342
C        (FIRST STATION OF THE REGION)
         GMA     = AMAX1(GMALB,-GMAUB)
         GO TO 345
C        (LAST STATION OF THE REGION)
   342   GMA     = AMIN1(GMALB,-GMAUB)

   345   ADS1    = ADS1+GMA
         ADS1LB= GMA-GMALB
         ADS1UB= -GMA-GMAUB
         IF(ABS(GMA).GE.TOLS1) GO TO 332

C       MOVE THE INTERIOR POINTS
   348   M       = MA
         GO TO 410
   350   CALL GETIX
         DS1(K)= DS1(K)+ADS1
         IF(DS1(K)) 360,400,380
C        (MOVE POINT UPSTREAM)
   360   IF(MU) 361,381,361
   361   DELS1 = S1(M)-S1(MU)
         DS1(K)= AMAX1(-.5*DELS1,AMIN1(DS1(K),.25*DELS1))
         G       = -DS1(K)/DELS1
```

```
      F      = 1.-G
      FF     = -G
      DR     = R(M)-R(MU)
      DZ     = Z(M)-Z(MU)
      PHIA   = PHI1(MU)
      PHIB   = PHI1(M)
      CURV(M)=CURV(MU)*G + CURV(M)*F
      GO TO 390
C     (MOVE POINT DOWNSTREAM)
  380 IF(MD) 381,361,381
  381 DELS1  = S1(MD)-S1(M)
      DS1(K)= AMAX1(-.25*DELS1,AMIN1(DS1(K),.5*DELS1))
      F      = DS1(K)/DELS1
      G      = 1.-F
      FF     = F
      DR     = R(MD)-R(M)
      DZ     = Z(MD)-Z(M)
      PHIA   = PHI1(M)
      PHIB   = PHI1(MD)
C        CHECK FOR DOWNSTREAM LEADING EDGE STAGNATION POINT
         MSV    = M
         M      = MD
         CALL GETIX
         MD     = M
         M      = MSV
         IF(ISTAG.NE.1) GO TO 383
         LX     = 0
         CALL STANO(MD,LX,UPPER)
         PHIB   = ANGLE(LX)
         GO TO 390
  383 CURV(M)=CURV(M)*G + CURV(MD)*F
  390 ANGCHD= ATAN3(DR,DZ,PHIA)
      YPA    = PHIA-ANGCHD
      YPB    = PHIB-ANGCHD
C     CALL BFI
       YQDX  = F*G*(G*YPA-F*YPB)
       ANGM  = YPA*(3.*G-2.)*G + YPB*(3.*F-2.)*F
      R(M)   = R(M) + (FF*DR+YQDX*DZ)
      Z(M)   = Z(M) + (FF*DZ-YQDX*DR)
      PHI1(M)=ANGCHD+ANGM
      S1(M)  = S1(M)+DS1(K)

  400 M      = M+1
      K      = K+1
  410 IF(M-MB) 350,350,450

C    INDEX TO THE NEXT STATION
  450 IF(IC.GE.NIC) GO TO 470
      IC     = IC+1
      GO TO 302

C    LOOP AGAIN THROUGH STATIONS IN THE REGION
  470 IF(LOOP.EQ.2) GO TO 500
      LOOP   = 2
      GO TO 260

C    CONTINUE TO NEXT REGION
  500 L      = LC(NIC)
      LAST   = L
      IF(X2CL(L).EQ.BITS) L=L+LNEXT(L)
      GO TO 210
```

```
  900 RETURN

 1330 FORMAT(45H ***  THE ORTHOGONAL LINE ADJUSTMENTS AT STA=F6.3,4H (L=
     &I4,35H) ARE UNREASONABLY LARGE.  (PTMOVE))
      END
```

```
*DECK REFINE
      SUBROUTINE REFINE
*REFINE          REFINE THE GRID BY SUBDIVIDING      *REFINE*

C     INPUT-
C      Z,R,PHI1,S1,S2,VM,B FIELD VALUES
C      /CREFIN/ DATA EXCEPT SLS
C      CRXSL  = NEW SL EXTENSION CRITERIA
C      CRXSS  = EXTENSION CRITERIA FOR NEW OL IN REGION WITH SOME SS-FLOW
C      CRXOL  = NEW OL EXTENSION CRITERIA
C      CRXE   = EXTENSION CRITERIA FOR NEW OL WHICH CROSSES SONIC LINE
C      CRXC   = EXTENSION CRITERIA FOR NEW OL WHICH CROSSES SHOCK WAVE
C      CRMACH= UPPER MACH NUMBER LIMIT FOR OL EXTENSION
C      CRXSL  = NEW SL EXTENSION CRITERIA
C      CRXSS  = EXTENSION CRITERIA FOR NEW OL IN REGION WITH SOME SS-FLOW
C      CRXOL  = NEW OL EXTENSION CRITERIA
C      CRXE   = EXTENSION CRITERIA FOR NEW OL WHICH CROSSES SONIC LINE
C      CRXC   = EXTENSION CRITERIA FOR NEW OL WHICH CROSSES SHOCK WAVE
C      CRMACH= UPPER MACH NUMBER LIMIT FOR OL EXTENSION

C     OUTPUT-
C      SG1REF= AVG OF MIN AND AVERAGE DIST BET OL*S

C     STATION TABLE
C      INDEX- L=LO,LESTA
C      SCHOKE= STATION CHOKE INDICATOR (ADJWF,BRHS,WRIOUT)
C      MCL    = SHARP CORNER INDICATOR (BLDTBS)
C      MCL    = FIELD INDEX OF CONTROL STREAMLINE (PTMOVE,FLOBAL)
      COMMON /CHDATA/ X1(1),LNEXT(1),MLB(1),MUB(1),PRIM(1),
     1                TYPELB(1),NAMELB(1),ILB(1),FLB(1),S1LB(1),
     1                TYPEUB(1),NAMEUB(1),IUB(1),FUB(1),S1UB(1),
     &                VMB(1),DWDV(1),X2CL(1),SLSWI(1),MCL(1),
     &                ANGTE(1),PTTE(1),PSTE(1),FGRTE(1),RGTE(1),
     &                ANGEXP(1),BSQEXP(475)
       DIMENSION      CRVLE(1),ANGLE(1)
       EQUIVALENCE    (SCHOKE,DWDV),(CRVLE,ANGTE),(ANGLE,PTTE)
       INTEGER        PRIM,TYPELB,TYPEUB,SCHOKE(1)
C
      COMMON /SLTAB / W(128),X2(128),SLCHN(128)
       INTEGER SLCMN
      COMMON /ALLCOM/ MACHA,PSA,TSA,PTA,TTA, AXIA,RGA,GAMA,
     1                MACHC,PSC,TSC,PTC,TTC, AXIC,RGC,GAMC,
     2                DAXIT,SCALEA,TTE,CHOTST
       REAL           MACHA(1),MACHC
       LOGICAL        AXIA,AXIC
       LOGICAL        CHOTST
      COMMON /CB    / B(300)
      COMMON /CBITS / BITS,BLANK
      COMMON /CCRX  / CRXSL,CRXOL,CRXSS,CRXE,CRXC,CRMACH
       COMMON /CEDUMP/  IGODMP
      COMMON /CIDEX / M,J,MU,MD,ISTAG
      COMMON /CM    / JMS(300)
      COMMON /CMAXIT/ MAXIT,MAJCTR,GREFIN,EDUM
       LOGICAL                        GREFIN
      COMMON /CPHI1 / PHI1(300)
      COMMON /CPI   / PI,TWOPI,PIO2,PIO4,TODEG,TORAD
      COMMON /CPRINT/ RDUM1(3),PREFIN,PREFN2,SSONIC,PDUM(10)
       LOGICAL        PRTDB
      COMMON /CR    / R(300)
      COMMON /CREFLE/ RLE1,RLE2,RLE3,HLE
       INTEGER                        HLE
      COMMON /CREFIN/ SLS,SG21,VMG1,VMG2
```

```
     1,                   NGR,NGZ, SGR(10),GR(10), SGZ(10),GZ(10)
      COMMON /CS1    / S1(300)
      COMMON /CS2    / S2(300)
      COMMON /CTABPR/ I1TAB
      COMMON /CTOLRL/ TOLRL(12),SG1REF,TOLINR
      COMMON /CVM    / VM(300)
      COMMON /CZ     / Z(300)

      COMMON /ERASE2/ CR(128),DELS(128),DELVM(128),LSTA(128),MJ2(128),
     1                SGX(128),SGY(128),RAV(128),ZAV(128), IA(16),IB(16)
      COMMON /IXORIG/ LHO,LHE, LBDO,LBDE, LTO,LTE, LWO,LWE, LFO,LFE,
     *                LO,LESTA,LSO,LSE,LDUM(6),
     *                MO,NM, NJ,NFCOLS, MAXNJ,MAXOL,MAXNM,MAXLE,
     *                LEO,LEE, LRO,LRE,LRD

      INTEGER         EXT,FIELD,HINT,TE
      LOGICAL         DOWNB,EXTND1,EXTND2,HALVE,NEWSL,SSP,UPPER

      DATA EXT,FIELD,HINT,TE/3HEXT,5HFIELD,3HINT,2HTE/

      IGODMP= 4
      GREFIN= .FALSE.
      QVMG1 = 1./VMG1
      QVMG2 = 1./VMG2
      X1NOT = -1.

C     CHECK TO SEE IF PARTIAL OL SHOULD BE EXTENDED
C     CHECK TO SEE IF PARTIAL SL SHOULD BE EXTENDED
C      OMIT

C*** EXAMINE GRID INCREMENT BETWEEN ORTHOGONALS
  300 L1     = LO
      NAVG   = 0
      SG1AVG= 0.
      SG1MIN= 1.E6
      SGMX   = 0.
      SGMX2 = 0.

C     CHECK FOR ADJACENT STATIONS AND DETERMINE THE BASE STATION -
C       A BASE STATION IS THE OL UPSTREAM OF LE STAG PT,
C       DOWNSTREAM OF A TE, OR THE SHORTEST OF (PARTIAL) OL'S,
C       OTHERWISE THE BASE STATION CAN BE EITHER THE UPSTREAM OR DOWNSTRE
C      DOWNB = DOWNSTREAM BASE STATION
  305 L2     = L1+LNEXT(L1)
      IF(L2.GE.LESTA) GO TO 99
      MA1    = MLB(L1)
      M      = MA1
      CALL GETIX
      MAD1   = MD
      MB1    = MUB(L1)
      M      = MB1
      CALL GETIX
      MBD1   = MD
      MA2    = MLB(L2)
      M      = MA2
      CALL GETIX
      MAU2   = MU
      MB2    = MUB(L2)
      M      = MB2
      CALL GETIX
      MBU2   = MU
```

```
C     ADJACENT STATION TEST
       IF((MA2.LE.MAD1  .AND. MAD1.LT.MB2)   .OR.
      1    (MA2.LT.MBD1  .AND. MBD1.LE.MB2)   .OR.
      2    (MA1.LE.MAU2  .AND. MAU2.LT.MB1)) GO TO 330

C         CHECK FOR TE FOLLOWED BY LE
          IF(MAJCTR.GE.1) GO TO 550
          IF(TYPELB(L1).NE.TE) GO TO 322
          M      = MA1
          GO TO 324
  322     IF(TYPEUB(L1).NE.TE) GO TO 550
          M      = MB1
  324     CALL GETIX
          CALL STAX1(X1(L1),X2(J),X2(J),LXB,LXA)
C         LXB,LXA ARE STATIONS BELOW AND ABOVE THE TRAILING EDGE.
C         IF L2 IS A LEADING EDGE STATION FOLLOWING L1, THEN L1 MUST
C         BE THE SECOND OF THE TWO TE STATIONS.
          IF(L1.EQ.LXA  .OR. L1.EQ.LXB) GO TO 325
  325     IF(LXB.GT.L1  .OR. LXA.GT.L1) GO TO 550

C         INSERT AN ORTHOGONAL BETWEEN THE TRAILING EDGE AND
C           LEADING EDGE STATIONS.
C          DEFINE MJ2(I),CR(I),NI, DOWNB,L,L3
          I      = 0
          M      = MLB(LXB)
  326     I      = I+1
          MJ2(I)= M
          CR(I) = 2.
          M      = M+1
          IF(M.LE.MUB(LXB)) GO TO 326
          M      = MLB(LXA)
  327     I      = I+1
          MJ2(I)= M
          CR(I) = 2.
          M      = M+1
          IF(M.LE.MUB(LXA)) GO TO 327
          NI     = I
          DOWNB = .FALSE.
          L      = L1
          L3     = L2
       GO TO 440

C     NUMBER OF PRIMARY STATIONS
  330 NPRIM = 0
       IF( PRIM(L1).OR.PRIM(L2)) NPRIM=1
       IF( PRIM(L1).AND.PRIM(L2) ) NPRIM=2
       LBASE = L1
       IF(NPRIM-1) 340,350,360
C     NO PRIM STATIONS
  340 IF(MAU2.GT.MA1  .OR. MBU2.LT.MB1) GO TO 380
       GO TO 370
C     ONE PRIM STATION
  350 IF(PRIM(L1)) GO TO 380
       GO TO 370
C     BOTH L1 AND L2 ARE PRIM STATIONS
  360 IF((MB2-MA2).GT.(MB1-MA1)) GO TO 380

C     UPSTREAM BASE STATION
  370 DOWNB = .FALSE.
       MA     = MA1
```

```
      MB      = MB1
      L       = L1
      L3      = L2
      GO TO 390

C     DOWNSTREAM BASE STATION
  380 DOWNB= .TRUE.
      MA      = MA2
      MB      = MB2
      L       = L2
      L3      = L1


C     CHECK L.E. REFINEMENT CRITERIA
  390 IF(MAJCTR.EQ.0) GO TO 400
      IF(TYPELB(L3).NE.HLE .AND. TYPEUB(L3).NE.HLE) GO TO 395
C      NEW ORTHOGONAL IN FRONT OF L.E.
      IF(DOWNB) GO TO 394
      MX      = MBU2
      IF(TYPELB(L3).EQ.HLE) MX=MAU2-1
      S2B     = S2(MX)-S2(MX-1)
      S2A     = S2(MX+2)-S2(MX+1)
      M       = MX-1
      CALL GETIX
      S1B     = S1(MD)-S1(M)
      M       = MD
      CALL GETIX
      S1B2    = S1(MD)-S1(M)
      M       = MX+2
      CALL GETIX
      S1A     = S1(MD)-S1(M)
      M       = MD
      CALL GETIX
      S1A2    = S1(MD)-S1(M)
      IF((S1A.LE.RLE1*S2A .OR. S1B.LE.RLE1*S2B)
     *.OR. S1A.LT.(.2*S1A2) .OR. S1B.LT.(.2*S1B2)) GO TO 550
      GO TO 400
C      NEW ORTHOGONAL BEHIND L.E.
  394 M       = MB1-1
      IF(TYPELB(L3).EQ.HLE) M=MA1+1
      CALL GETIX
      S1A2    = S1(MD)-S1(M)
      DR      = R(M)-R(MU)
      DZ      = Z(M)-Z(MU)
      S1A     = SQRT(DZ*DZ+DR*DR)
      IF(S1A2.LE.RLE2*S1A) GO TO 550
      GO TO 400

C     INHIBIT REFINEMENT AROUND A FIXED STAGNATION POINT
  395 M       = MLB(L3)
      CALL GETIX
      IF(ISTAG.NE.1) GO TO 399
      IF(DOWNB) GO TO 397
C      NEW OL IN FRONT OF STAG PT ON LOWER BDY
      S2A     = S2(MAU2+1)-S2(MAU2)
      M       = MAU2+1
  396 CALL GETIX
      S1A     = S1(MD)-S1(M)
      IF(S1A.LE.RLE1*S2A) GO TO 550
      GO TO 400
C      NEW OL BEHIND STAG PT ON LOWER BDY
```

```
  397 M       = MA1+1
  398 CALL GETIX
      S1A2    = S1(MD)-S1(M)
      DR      = R(M)-R(MU)
      DZ      = Z(M)-Z(MU)
      S1A     = SQRT(DZ*DZ+DR*DR)
      IF(S1A2.LE.RLE2*S1A) GO TO 550
      GO TO 400
C      NEW OL IN FRONT OF STAG PT ON UPPER BDY
  399 M       = MUB(L3)
      CALL GETIX
      IF(ISTAG.NE.1) GO TO 400
      IF(DOWNB) GO TO 3992
      S2A     = S2(MBU2)-S2(MBU2-1)
      M       = MBU2-1
      GO TO 396
C      NEW OL BEHIND STAG PT ON UPPER BDY
 3992 M       = MB1-1
      GO TO 398



C**  SWEEP ACROSS THE STREAMLINES TO CHECK FOR REQD GRID REFINEMENT
C     BETWEEN ORTHOGONALS L1 AND L2
  400 X1L3    = X1(L3)
      LX      = L1
      I       = 0
      M       = MA
      CRXL    = CRXOL
      SSP     = .FALSE.
  420 CALL GETIX
      MX      = MD
      IF(DOWNB) MX=MU
      IF(MX.EQ.0) GO TO 430
      CALL STANO(MX,LX,DUM)
      IF(X1(LX).NE.X1L3) GO TO 430
      I       = I+1
      DELS(I)= ABS(S1(MX)-S1(M))
C       CALC LARGEST, NEXT LARGEST DISTANCES BETWEEN ORTHOGONALS, SGMX,S
C        FOR DETERMINING NUMBER OF EXTRA SL@S
         IF(MAJCTR.GE.1) GO TO 425
         IF(DELS(I).LT.SGMX) GO TO 423
         SGMX2 = SGMX
         SGMX  = DELS(I)
         GO TO 425
  423    IF(DELS(I).GE.SGMX2) SGMX2=DELS(I)
C       MINIMUM DISTANCE BETWEEN ORTHOGONALS
  425   SG1MIN= AMIN1(SG1MIN,DELS(I))
C       AVERAGE DISTANCE BETWEEN ORTHOGONALS
        SG1AVG= SG1AVG+DELS(I)
        NAVG  = NAVG+1
      DELVM(I)=ABS(VM(MX)-VM(M))*QVMG1
      RAV(I)= .5*(R(MX)+R(M))
      ZAV(I)= .5*(Z(MX)+Z(M))
      MJ2(I)= M
C      CHECK FOR SUPERSONIC FLOW
      IF(B(M).LT.0. .OR. B(MX).LT.0.) SSP=.TRUE.
C      CHECK FOR TRANSONIC EXPANSION OR COMPRESSION
      IF(B(MX)*B(M).GE.0.) GO TO 430
      IF(DOWNB) MX=M
      CRXL1 = CRXE
```

```
      IF(B(MX).GE.0.) CRXL1=CRXC
      CRXL   = AMIN1(CRXL1,CRXL)
  430 M      = M+1
      IF(M.LE.MB) GO TO 420
      IF(CRXSS.LE.CRXL .AND. SSP) CRXL=CRXSS
      IF(MAJCTR.EQ.0) CRXL=0.
      NI     = I
      CALL LFIT1(GR,SGR,NGR, RAV,SGY,NI)
      CALL LFIT1(GZ,SGZ,NGZ, ZAV,SGX,NI)
      HALVE = .FALSE.
      DO 432 I=1,NI
      RS     = DELS(I)/AMAX1(SGX(I),SGY(I))
      CR(I) = RS + DELVM(I)*RS**.2
  432 IF(CR(I).GT.1.) HALVE=.TRUE.

C     PREVENT TOO RAPID CHANGE IN OL SPACING BY FORCING A NEW OL
      IF(HALVE) GO TO 440
      X1D12 = .5*(X1(L2)-X1(L1))
      IF(PRIM(L1)) GO TO 436
      IF((X1(L1)-X1(L1M)).LT.X1D12) HALVE=.TRUE.
      GO TO 437
  436 L1M    = L1
  437 IF(PRIM(L2)) GO TO 438
      L2P    = L2+LNEXT(L2)
      IF((X1(L2P)-X1(L2)).LT.X1D12) HALVE=.TRUE.
      GO TO 439
  438 L2P    = L2
  439 IF(.NOT.HALVE) GO TO 550
      IF(TYPELB(L1).EQ.FIELD .OR. TYPELB(L1M).EQ.FIELD .OR.
     *   TYPELB(L2).EQ.FIELD .OR. TYPELB(L2P).EQ.FIELD) GO TO 4391
      CR(1) = 1.
      GO TO 440
 4391 CR(NI)=1.

C     PREVENT TOO RAPID CHANGE IN OL SPACING BY SUPPRESSING NEW OL-S IN
C       EARLY STAGES OF REFINEMENT
  440 IF(MAJCTR.EQ.0 .OR. MAJCTR.GE.4) GO TO 445
C       CHECK ONE POINT ONLY
      I      = NI/2 + 1
      M      = MJ2(I)
      CALL GETIX
      IF(DOWNB) GO TO 441
      MU1    = MU
      M1     = M
      MX     = MD
      M      = MX
      CALL GETIX
      MD1    = MD
      GO TO 442
C     DOWNB=T
  441 M1     = MU
      MX     = M
      MD1    = MD
      M      = M1
      CALL GETIX
      MU1    = MU
  442 DS1U   = 0.
      IF(MU1.EQ.0) GO TO 443
      DZ     = Z(M1)-Z(MU1)
      DR     = R(M1)-R(MU1)
      DS1U   = SQRT(DZ*DZ+DR*DR)
```

```
  443 DS1D   = 0.
      IF(MD1.EQ.0) GO TO 444
      DS1D   = S1(MD1)-S1(MX)
  444 IF(DELS(I).GE.(.4*DS1U) .AND. DELS(I).GE.(.2*DS1D)) GO TO 445
      X1NOT = X1(L)
      GO TO 550

C**  ADD A NEW ORTHOGONAL LINE BETWEEN L1 AND L2. FIRST CHECK MEMORY
  445 X1NEW = .5*(X1(L1)+X1(L2))
      EXTND1= .TRUE.
      EXTND2= .TRUE.
      IF(TYPELB(L).EQ.FIELD) EXTND1=.FALSE.
      IF(TYPEUB(L).EQ.FIELD) EXTND2=.FALSE.
      IRET   = 0
      IF((LESTA+20).LE.MAXLE) GO TO 800
      WRITE (6,1440) X1NEW
      GO TO 99
  450 IF(NL.EQ.1) GO TO 455
      WRITE (6,1450) NL,X1NEW
 1450 FORMAT(/3X,I2,1X1/HOL-S REQUESTED ATF8.3,)
      IB(1) = IB(NL)
      NL     = 1

C**  ADJUST FIELD ARRAYS FOR THE NEW OL
  455 NPTS   = IB(1)-IA(1)+1
      GREFIN= .TRUE.
      CALL ADDFPT(MA2,NPTS,999999)

C     CORRECT THE POINTERS IN THE JMS-TABLE
      MNEW   = MA2
      MA     = MNEW
      I      = IA(1)
  460 IF(DOWNB) GO TO 470

C      (UPSTREAM BASE STATION)
C      UPSTREM POINT
      M      = MJ2(I)
      CALL GETIX
      MDSAV = MD
      MD     = MNEW
      CALL SAVIX
C      NEW POINT
      MU     = M
      M      = MNEW
      MD     = MDSAV
      ISTAG = 0
      CALL SAVIX
C      DOWNSTREAM POINT
      M      = MD
      CALL GETIX
      MU     = MNEW
      CALL SAVIX
      GO TO 490

C      (DOWNSTREAM BASE STATION)
C      DOWNSTREAM POINT
  470 M      = MJ2(I)+NPTS
      CALL GETIX
      MUSAV = MU
      MU     = MNEW
      CALL SAVIX
```

```
C       NEW POINT
        MD      = M
        M       = MNEW
        MU      = MUSAV
        ISTAG  = 0
        CALL SAVIX
C       UPSTREAM POINT
        M       = MU
        CALL GETIX
        MD      = MNEW
        CALL SAVIX

  490 I       = I+1
        MNEW   = MNEW+1
        IF(IB(1)-I) 495,460,460
  495 MB      = MNEW-1

C**  MODIFY STATION-TABLE
  500 CALL INSTA(L2,L,L3,DOWNB, MA,MB)

C     INCREMENT TO THE NEXT ORTHOGONAL INTERVAL
  550 L1M     = L1
        L1      = L2
        GO TO 305

C     AVERAGE DIST BET ORTHOGS
   99 SG1AVG= SG1AVG/FLOAT(NAVG)
        SG1REF= .5*(SG1MIN+SG1AVG)

C*** EXAMINE GRID INCREMENT ABOVE STREAMLINE J2, (J2=1,NJ)
        J2      = 1
  100 J2NEXT= J2+1
        IF(W(J2+1).EQ.0.) GO TO 200
C           NEXTRA= NO OF EXTRA SL.S NEAR THE BODY FOR CHN=EXT,INT
            NEXTRA= 0
            IF(MAJCTR.GT.0 .OR. (SLCHN(J2).NE.EXT .AND. SLCHN(J2).NE.HINT))
     1          GO TO 104
            M       = MBEGIN(J2)
            DSOL    = SGMX2/2.
            RROL    = (R(M+1)-R(M))/DSOL
            IF(AXIA) RROL=(R(M+1)*R(M+1)-R(M)*R(M))/(DSOL*(R(M)+DSOL))
            RR      = 0.
            IF(R(M).LE..1) GO TO 101
C           THE FIRST SL IS TO BE PLACED ABOUT ONE BODY RADIUS AWAY
            RRATIO= R(M+1)/R(M)
            RR      = RRATIO-1.
            IF(AXIA) RR=(RRATIO*RRATIO-1.)/3.
  101       RR      = AMAX1(RR,RROL)
C           NEXTRA= MAX0(1,MIN0(INT(ALOG(RR)/ALOG(2.))-1,8))
            NEXTRA= MAX0(1,INT(ALOG(RR)/ALOG(2.)))
  104 M       = MBEGIN(J2)
C       M       = THE FIRST POINT ON THE STREAMLINE
        EXTND1= .TRUE.
        EXTND2= .TRUE.
        L       = 0
        WMIN    = 1.E6
        I       = 1
  110 CALL GETIX
        MNEXT = MD
        CALL STANO(M,L,UPPER)
C        BYPASS UPPER BOUNDARY OF PARTIAL OL
```

```
      IF(UPPER) GO TO 120
C      CHECK L.E. REFINEMENT CRITERIA
       IF(ISTAG.NE.1) GO TO 114
       S2A    = S2(MU+1)-S2(MU)
       DZ     = Z(M+1)-Z(MU+1)
       DR     = R(M+1)-R(MU+1)
       S1A    = SQRT(DZ*DZ+DR*DR)
       DZ     = Z(MD+1)-Z(M+1)
       DR     = R(MD+1)-R(M+1)
       S1A2   = SQRT(DZ*DZ+DR*DR)
       IF((S2A.LT.RLE3*S1A .OR. S2A.LT.RLE3*S1A2) .AND. MAJCTR.GE.1)
     1 GO TO 200
  114 LSTA(I)=L
      MJ2(I)= M
      DELS(I)=S2(M+1)-S2(M)
C     (NOTE-S2 IS NOT UPDATED IF THIS IS FOR AN EXTRA SL)
      DELVM(I)=ABS(VM(M+1)-VM(M))*QVMG2
      ZAV(I)= .5*(Z(M+1)+Z(M))
      RAV(I)= .5*(R(M+1)+R(M))
      M      = M+1
      CALL GETIX
      IF(I.EQ.1 .AND. MU.NE.0) EXTND1=.FALSE.
      IF(MNEXT.EQ.0 .AND. MD.NE.0) EXTND2=.FALSE.
C      CHECK L.E. REFINEMENT CRITERIA
       IF(ISTAG.NE.1) GO TO 117
       S2B    = S2(MU)-S2(MU-1)
       DZ     = Z(MU-1)-Z(M-1)
       DR     = R(MU-1)-R(M-1)
       S1B    = SQRT(DZ*DZ+DR*DR)
       DZ     = Z(MD-1)-Z(M-1)
       DR     = R(MD-1)-R(M-1)
       S1B2   = SQRT(DZ*DZ+DR*DR)
       IF((S2B.LT.RLE3*S1B .OR. S2B.LT.RLE3*S1B2) .AND. MAJCTR.GE.1)
     1 GO TO 200
  117 IF(W(J).GE.WMIN) GO TO 119
      WMIN   = W(J)
      X2MIN  = X2(J)
  119 I      = I+1
  120 M      = MNEXT
      IF(M.NE.0) GO TO 110
      NI     = I-1
      CALL LFIT1(GR,SGR,NGR, RAV,SGY,NI)
      CALL LFIT1(GZ,SGZ,NGZ, ZAV,SGX,NI)
C     CR(I)=1 IS THE RADIUS OF PERMISSIBLE GRID SIZE
      HALVE = .FALSE.
      DO 132 I=1,NI
      RS     = ABS(DELS(I))/(AMAX1(SGX(I),SGY(I))*SG21)
      CR(I) = RS + DELVM(I)*RS**2
      IF(CR(I).GT.1.) HALVE=.TRUE.
  132 CONTINUE

C*** IF HALVE=T ADD NEW SL FOR STATIONS FOR WHICH CR.GT.5
      IF(.NOT.HALVE) GO TO 200
      IRET   = -1
      CRXL   = CRXSL
      IF(MAJCTR.EQ.0) CRXL=0.
      GO TO 800
  145 WNEW   = .5*(W(J2)+WMIN)
      XI2    = .5*(X2(J2)+X2MIN)

C    BEGIN LOOP FOR INSERTING THE (PARTIAL) STREAMLINE, LI=1,NL
```

```
      LI     = 1
      NPTADD= 0
  150 I1     = IA(LI)
      I2     = IB(LI)
      IF(I1.EQ.0) GO TO 195

C     DETERMINE J1, INDEX OF NEW SL
      J      = J2
  160 IF(W(J).GT.WNEW) GO TO 170
      J      = J+1
      IF(J.GT.NJ) CALL ERROR1
      GO TO 160
  170 J1     = J

C     ADJUST FIELD ARRAYS AND  SL TABLES
      NEWSL  = .TRUE.
      I      = I1
      MU1    = 0
      IF(NJ.LT.MAXNJ) GO TO 180
      WRITE (6,1175) XI2
      RETURN
  180 L      = LSTA(I)
      M1     = MJ2(I)+NPTADD+1
      MD1    = 0
      CALL ADPTSL(M1,MU1,MD1,J1,NEWSL)
      NPTADD= NPTADD+1
      M      = M1+1
      CALL GETIX
      JP     = J
      M      = M1-1
      CALL GETIX
      JM     = J
      M      = M1
      J      = J1
      W(J)   = WNEW
      X2(J)  = XI2
      M      = M1
      F      = (WNEW-W(JM))/(W(JP)-W(JM))
      DZ     = Z(M+1)-Z(M-1)
      DR     = R(M+1)-R(M-1)
      IF(.NOT.AXIA .OR. ABS(DR).LT..01*ABS(R(M-1))) GO TO 1804
      T      = R(M-1)/DR
      F      = SIGN(SQRT(T*T+(T+T+1.)*F),DR) - T
 1804 ANGCHD= ATAN3(DR,DZ,PHI1(M-1))
      YPA    = PHI1(M-1)-ANGCHD+PIQ2
      YPB    = PHI1(M+1)-ANGCHD+PIQ2
      G      = 1.-F
      YQDX   = F*G*(G*YPA-F*YPB)
      R(M)   = YQDX*DZ+F*DR + R(M-1)
      Z(M)   = F*DZ-YQDX*DR + Z(M-1)
      B(M)   = G*B(M-1)+F*B(M+1)
      S1(M)  = G*S1(M-1)+F*S1(M+1)
      VM(M)  = G*VM(M-1)+F*VM(M+1)
      PHI1(M)=G*PHI1(M-1)+F*PHI1(M+1)
C      SET ISTAG=3 FOR PTS ADJACENT TO L.E. AND BOUNDARY CORNER PTS.
      IF(IPRIM(L).EQ.0) GO TO 185
       M      = M1-1
       CALL GETIX
       ISTAGM= ISTAG
       M      = M1+1
       CALL GETIX
```

```
      IF(ISTAGM.EQ.1) GO TO 181
      IF(ISTAG.NE.1) GO TO 185
C     (ISTAGP=1)
      ISTAGM= 0
      GO TO 182
C     (ISTAGM=1)
  181 ISTAG = 0
      CALL SAVIX
  182 M     = M1
      CALL GETIX
      ISTAG = 3
      CALL SAVIX
      M     = M1-1
      CALL GETIX
      ISTAG = ISTAGM
      CALL SAVIX

C     UPDATE THE STATION-TABLE POINTERS TO THE FIELD-TABLE
  185 CALL STTOFI(L,1)
      GREFIN= .TRUE.

C     INDEX TO NEXT PT ON SL
      NEWSL = .FALSE.
  190 I     = I+1
      MU1   = M1
      IF(I2-I) 194,180,180

C     INDEX TO NEXT PARTIAL SL
  194 J2NEXT= J2NEXT+1
  195 LI    = LI+1
      IF(NL-LI) 200,150,150

C     LOOP TO PUT IN ADDITIONAL SL-S FOR EXTERNAL CHANNELS
  200 IF(NEXTRA.EQ.0) GO TO 210
      NEXTRA= NEXTRA-1
      GO TO 104

C     INCREMENT THE STREAMLINE COUNTER J2
  210 J2    = J2NEXT
      IF(J2.LT.NJ) GO TO 100

C     PRINT COMMENT IF AN OL WAS SUPPRESSED AND NO OTHER GRID REFINEMENT
      IF(.NOT.GREFIN .AND. X1NOT.GE.0.) WRITE(6,1700) X1NOT
      RETURN


C*** EVALUATION OF NEW LINE POSITIONS
C     OUTPUT-
C     NL NEW LINES ARE TO BE IN THE REGIONS IA(LI) TO IB(LI), LI=1,NL
C     FOR IA(LI).NE.0.

C     SEARCH FOR CR.GT.1. POINT
  800 NL    = 0
      I     = 1
  805 IF(CR(I).GE.1.) GO TO 810
      I     = I+1
      IF(I.LE.NI) GO TO 805
      GO TO 840

C     FIND  IA,IB  SO THAT  CR.GE..375 IS WITHIN  IA,IB
  810 NL    = MIN0(NL+1,10)
```

```
      ISAVE  = I
  815 IA(NL)= I
      I      = I-1
      IF(I.GE.1 .AND. (I.GE.(ISAVE-3).OR.CR(I).GE.CRXL)) GO TO 815
      I      = ISAVE
  820 IB(NL)= I
      I      = I+1
      IF(I.GT.NI) GO TO 840
      IF(CR(I).GE.1.) ISAVE=I
      IF(I.LE.(ISAVE+3) .OR. CR(I).GE.CRXL) GO TO 820

C     REPEAT THE ABOVE FOR THE NEXT PARTIAL LINE
      IF(I.LT.NI) GO TO 805

C     ADD ONLY ONE LINE IF NL.EQ.10
  840 IF(NL.NE.10) GO TO 850
      NL     = 1
      IB(1)  = IB(10)

C     ELIMINATE THE SHORT GAPS BETWEEN LINES
  850 IF(NL.LE.1) GO TO 860
      LILAST= 1
      DO 855 LI=2,NL
      IF((IA(LI)-IB(LI-1)).GT.7) GO TO 854
      IB(LI-1)=IB(LI)
      IA(LI)= 0
      GO TO 855
  854 LILAST= LI
  855 CONTINUE
      NL     = LILAST
  860 IF(IA(1).LE.2 .AND. EXTND1) IA(1)=1
      IF((NI-IB(NL)).LE.2 .AND. EXTND2) IB(NL)=NI

C     EXTEND EACH LINE TO A MINIMUM OF FIVE POINTS
      NPTS   = 0
      DO 870 LI=1,NL
      IF(IA(LI).EQ.0) GO TO 870
  865 IDEF   = MAX0((5-(IB(LI)-IA(LI)))/2, 0)
      IA(LI)= MAX0(IA(LI)-IDEF,1)
      IB(LI)= MIN0(IB(LI)+IDEF,NI)
      NPTS   = NPTS + IB(LI)-IA(LI)+1
      IF(NPTS.LT.5 .AND. NPTS.LT.NI) GO TO 865
  870 CONTINUE
      IF((NM+NPTS).LE.MAXNM) GO TO 890
      WRITE (6,1881) NM,MAXNM
      RETURN

C     RETURN
  890 IF(IRET) 145,450,450

 1175 FORMAT(38H ***  STREAMLINE LIMIT REACHED.  (XI2=F6.3,1H))
 1440 FORMAT(73H ***  STATION TABLE STORAGE LIMIT DOES NOT ALLOW A NEW O
     *RTHOGONAL AT XI1=F7.3,1H,/6X61HGRID REFINEMENT BY INSERTING ORTHOG
     *ONALS IS BEING TERMINATED.)
 1700 FORMAT(51H ***  GRID REFINEMENT OF ORTHOGONAL LINES NEAR XI1=F8.3,
     *52H WAS DELETED  BECAUSE OF LARGE VARIATION IN SPACING,/41H      R
     *EVISED  SGR,SGZ  INPUT IS DESIRED.)
 1881 FORMAT(71H ***  FIELD POINT STORAGE LIMIT PREVENTS FURTHER GRID RE
     *FINEMENT.  (NM=I4,8H, MAXNM=I4,1H))
      END
```

```
*DECK REFBLK
      BLOCK DATA REFBLK
*REFBLK         BLOCK DATA FOR REFINE                                    *REFBLK*
      COMMON /CREFLE/ RLE1,RLE2,RLE3,HLE
      DATA RLE1,RLE2,RLE3/.65,1.3,1.3/, HLE/2HLE/
      END
```

```
*DECK SLC
      SUBROUTINE SLC
*SLC---           STREAMLINE CURVATURE ETC                          *SLC*

C****CALCULATE ANGLE, CURVATURE AND ARC LENGTH ALONG STREAMLINES

C     INPUT-
C      B       = SUBSONIC SUPERSONIC INDICATOR, NEGATIVE FOR SUPERSONIC VEL
C      Z,R     = STREAMLINE COORDINATES
C      BRANCH= NOMINAL UPSTREAM STREAMLINE ANGLE FOR USE IN SELECTING
C              PROPER QUADRANT, =999. FOR EVALUATION FROM BOUNDARY TABLE

C     OUTPUT-
C      PHI1    = ANGLE IN RADIANS
C      CURV    = CURVATURE
C      S1      = ARC LENGTH


C   COMB4
C    STATAB, CADJWF, BDYTAB, WAKETB
C     BOUNDARY TABLE
C      INDEX- LB=LBDO,LBDE
C      LBNEXT= INCREMENT TO NEXT BOUNDARY
C      LBZ1   = INCREMENT TO THE FIRST BOUNDARY POINT (=0 BEFORE COALLATIO
C      CHNAME= CHANNEL WITH WHICH THE BOUNDARY DATA IS ASSOCIATED
C      UP     = T OR F FOR UPPER OR LOWER BOUNDARY
C      LEDEX  = RELATIVE INDEX OF L.E. POINT WHEN LOWER AND UPPER SURFACE
C              CONTOURS ARE CONNECTED
C      BDNAME,LBA,LBB=NAME AND INDEX LIMITS OF SPECIFIC BOUNDARY
C                       DATA WHEN BOUNDARIES ARE COALLATED
      DIMENSION          BDT(1),LBNEXT(1),LBZ1(1),
     1                   CHNAME(1),UP(1),LEDEX(1),
     2                   ZBT(1),RBT(1),ANGBT(42)
       LOGICAL           UP
       INTEGER BDT,CHNAME,BDNAME
       DIMENSION         BDNAME(1),LBA(1),LBB(1)
       EQUIVALENCE       (BDNAME,ZBT), (LBA,RBT), (LBB,ANGBT)
C     FLOW ADJUSTMENT TABLE
C      INDEX- LF=LFO,LFE
C      NFCOLS= 8
C      X1F     = ORTHOGONAL COORDINATE
C      X2F     = STREAMLINE COORDINATE OF SL EMINATING FROM T,E,
C      X1BF    = X1-COORDINATE OF CHOKE STATION OF FLOW BELOW T,E,
C      X1AF    = X1-COORDINATE OF CHOKE STATION OF FLOW ABOVE T,E,
C      S1F     = S1-COORDINATE OF T,E, (UPPER SURFACE), THIS ITEM
C               IS USED WHEN INTERPOLATING FOR WAKE DELTA-STAR,
C      LFB,LFA=INDICES OF STATIONS BELOW AND ABOVE T.E,
C      NCHB,NCHA=NUMBER OF CHANNELS BELOW AND ABOVE T.E,
C      LRF     = INDEX OF DUMMY ORTCHN LIST FOR THE T,E.
C      LRXF    = INDEX OF LAST CHANNEL BELOW THE T.E,
C      JORDER= 0 IF TOTAL FLOW AT X1F IS GIVEN
C             = 2 IF FLOW ABOVE T,E, IS GIVEN
C             = 1 IF FLOW BELOW T,E, IS GIVEN
C      JORDER= -1 IF FLOW AT X1F IS CHOKED AND SINGLE CHANNEL
      DIMENSION          X1F(1),X2F(1),X1BF(1),X1AF(1),
     1                   S1F(1),NCHB(1),NCHA(1),JORDER(1),VNR(12)
       EQUIVALENCE       (LFB,X1BF),(LFA,X1AF),(LRF,NCHB),(LRXF,NCHA)
       DIMENSION         LFB(1),LFA(1),LRF(1),LRXF(1)
C     STATION TABLE
C      INDEX- L=LO,LESTA
C      SCHOKE= STATION CHOKE INDICATOR (ADJWF,BRHS,WRIOUT)
C      MCL    = SHARP CORNER INDICATOR (BLDTBS)
```

```
C      MCL    = FIELD INDEX OF CONTROL STREAMLINE (PTMOVE,FLOBAL)
       COMMON /CHDATA/ X1(1),LNEXT(1),MLB(1),MUB(1),PRIM(1),
     1                 TYPELB(1),NAMELB(1),ILB(1),FLB(1),S1LB(1),
     1                 TYPEUB(1),NAMEUB(1),IUB(1),FUB(1),S1UB(1),
     &                 VMB(1),DWDV(1),X2CL(1),SLSWI(1),MCL(1),
     &                 ANGTE(1),PTTE(1),PSTE(1),FGRTE(1),RGTE(1),
     &                 ANGEXP(1),BSQEXP(475)
         DIMENSION     CRVLE(1),ANGLE(1)
         EQUIVALENCE   (SCHOKE,DWDV),(CRVLE,ANGTE),(ANGLE,PTTE)
         INTEGER       PRIM,TYPELB,TYPEUB,SCHOKE(1)
C    WAKE TABLE
       DIMENSION     X2W(1),LWNEXT(1),S1W(1),DST(1)
        EQUIVALENCE  (DST,S1W)
        EQUIVALENCE  (BDT,X1F,X2W,X1),(LBNEXT,X2F,LWNEXT,LNEXT)
        EQUIVALENCE  (LBZ1,X1BF,S1W,MLB)
        EQUIVALENCE   (CHNAME,X1AF,MUB), (UP,S1F,PRIM)
        EQUIVALENCE   (LEDEX,NCHB,TYPELB), (ZBT,NCHA,NAMELB)
        EQUIVALENCE   (RBT,JORDER,ILB), (ANGBT,VNR,FLB)
C
       COMMON /BENDIN/ NBCIN(2),ACF(2)
       COMMON /CB    / B(300)
       COMMON /CREAM / DBEAM(3),IORDER
       COMMON /CBEAM2/ DR,DZ,YPA,YPB,F,G, DX,YODX,ZM,RM,ANGM,CURVM,S1M,
     &                 RZONLY, ANGCHD,SINTVL, YPASQ,YPAB,YPBSQ
        LOGICAL        RZONLY
       COMMON /CBEND / NBCB(2),FB(2)
       COMMON /CBITS / BITS,BLANK
       COMMON /CBDYPT/ ANGD,CURVD
       COMMON /CCURV / CURV(300)
       COMMON /CFB   / L,MA,MB,J2,IA,IB,I,LTSL
       COMMON /CFB2  / PASS1
        LOGICAL        PASS1
       COMMON /CIDEX / M,J,MU,MD,ISTAG
       COMMON /CINNER/ INRCTR
       COMMON /CM    / JMS(300)
       COMMON /CMAXIT/ MAXREF,NREFIN
       COMMON /CPHI1 / PHI1(300)
       COMMON /CPI   / PI,TWOPI,PIO2,PIO4,TODEG,TORAD
       COMMON /CPRINT/ PDUMX(6),PDUM(20)
       COMMON /CPTMOV/ VELPOT,ICOB,NODENS,FBASTG
       COMMON /CQIREM/ XTOL,YO,DYDX,CTRMAX
       COMMON /CR    / R(300)
       COMMON /CS1   / S1(300)
       COMMON /CS2   / S2(300)
       COMMON /CSLC  / BRANCH(4)
       COMMON /CSS   / SSFML,SSEF,SSEANG,SSDF,SSFEND,SSFND1
     &                ,SSDLE,A4FACT,BRLX,CURRLX,TSIC
        INTEGER        SSFML
        LOGICAL               SSEF,        SSDF,    SSDLE
       COMMON /CTABPR/ I1TAB
       COMMON /CZ    / Z(300)
       COMMON /ERASE2/ RB(128),ZB(128),ANG(128),CURVB(128),S1B(128),
     &                 BI(128),J2DONE(128),MSV(128),CURSS(6),QV(8)
       COMMON /IXORIG/ LHO,LHE, LBDO,LBDE, LTO,LTE, LWO,LWE, LFO,LFE,
     &                 LO,LESTA,LSO,LSE,LDUM(6),
     &                 MO,NM, NJ,NFCOLS, MAXNJ,MAXOL,MAXNM,MAXLE,
     &                 LEO,LEE, LRO,LRE,LRD
       COMMON /SLTAB / W(128),X2(128),SLCHN(128)
        INTEGER        SLCHN
       LOGICAL         ALLJ2,ANYJ2,        J2PREV,PARSLA,UPPER
       INTEGER         TE
```

```
      DATA LE,TE/2HLE,2HTE/

      BETSQ(PTQS)=2.*FGRX*PTQS**FGTX - GX
      PM(BSQ)=SQRT(GX)*ATAN(SQRT(BSQ/GX)) - ATAN(SQRT(BSQ))

C     FIRST PASS ACROSS STREAMLINES, SKIP THOSE SL*S WHICH TERMINATE WITH
C      IN THE FIELD IF J2PREV=T,  AT END OF PASS  ALLJ2=T IF ALL STREAMLI
C      HAVE BEEN FITTED AND ANYJ2=T IF ONE OR MORE SL*S HAVE BEEN FITTED.
C      J2PREV=F IF ON THE PREVIOUS PASS NO SL*S WERE FITTED BECAUSE END
C      CONDITION INTERPOLATION REQUIREMENTS COULD NOT BE SATISFIED.
      IGODMP= 5
      ANYJ2 = .TRUE.
      IF(PDUM(1).GT.0.) WRITE(6,1159)
      CALL SETM(1,0, J2DONE,NJ)
      RZONLY= .FALSE.

C     BEGIN LOOP THROUGH FIRST TO LAST STREAMLINE, J2=1,NJ
C      CALL MBEGIN TO OBTAIN FIELD INDEX OF FIRST PT ON SL
  100 J2PREV= ANYJ2
      ANYJ2 = .FALSE.
      ALLJ2 = .TRUE.
      J2    = 1
  101 IF(J2DONE(J2).EQ.1)  GO TO 187
      M      = MBEGIN(J2)
      IF(PDUM(1).GT.0.) WRITE (6,1160) J2

C     BUILD ZB,RB,ANG ARRAYS FOR THE STREAMLINE SEGMENT
C      ISTAG=3 IS A BOUNDARY OF A PARTIAL ORTHOGONAL, SUCH POINTS
C      ARE TO BE BYPASSED AND THEN FILLED IN BY INTERPOLATION
  115 I      = 1
      S1B(1)= 0.
  120 IA     = I
      MA     = M
  121 CALL GETIX
      IF(ISTAG.EQ.3) GO TO 128
      RB(I) = R(M)
      ZB(I) = Z(M)
      ANG(I)= PHI1(M)
      BI(I) = B(M)
      MSV(I)= M
      IF(ISTAG.EQ.1 .OR. ISTAG.EQ.2) GO TO 130
  124 IF(MD) 126,130,126
  126 I      = I+1
      IB     = I
  128 M      = MD
      MB     = M
      GO TO 121

C     SET END CONDITIONS
  130 NBCB(1)=0
      NBCB(2)=0
      FB(1) = 0.
      FB(2) = 0.
      L     = 0
      MDSV  = MD
      ISTAGB= ISTAG
C     PARSLA= PARTIAL STREAMLINE AT END A, T OR F
      PARSLA= .FALSE.
C     LTSL  = TRAILING STREAMLINE INDICATOR, STATAB INDEX
      LTSL  = 0
```

```
      IEND   = 1
      MX     = MA
      IF(IA.EQ.1) GO TO 1304
      M      = MA
      CALL GETIX
      IF(ISTAG.EQ.2) GO TO 1318
 1302 IEND   = 2
      MX     = MB
      IF(MDSV.NE.0) GO TO 135
C      USE AVG CURVATURE B.C. FOR PARITAL SL*S
 1304 CALL STANO(MX,L,UPPER)
      IF(MX.EQ.MLB(L) .OR. UPPER .OR.
     +   L.EQ.LO .OR. (L+LNEXT(L)).GE.LESTA)  GO TO 1346
      M   = MLB(L)
      CALL GETIX
      IF(MU.EQ.0 .OR. MD.EQ.0) GO TO 1346
C           PARTIAL SL. SEARCH FOR NON-TERMINATING ADJACENT SL
           SUM    = 0.
           CURVX  = 0.
           M      = MX
           MCHNG  = -1
 1306      M      = M+MCHNG
           CALL GETIX
           IF(MU.EQ.0 .OR. MD.EQ.0) GO TO 1306
           IF(J2DONE(J).EQ.0 .AND. J2PREV) GO TO 186
           IF(INRCTR.NE.0) GO TO 1308
           IF(J2DONE(J).EQ.0) GO TO 1306
 1308      IF(M.LT.MLB(L) .OR. M.GT.MUB(L)) GO TO 1310
           SUM    = SUM+1.
           CURVX  = CURVX+.5*CURV(M)
 1310      IF(MCHNG.EQ.1) GO TO 1314
           M      = MX
           MCHNG  = 1
           GO TO 1306
 1314      CURVX  = CURVX/SUM
           NBCB(IEND)=2
           FB(IEND)=CURVX
           IF(IEND.EQ.1) PARSLA=.TRUE.
           GO TO 1348
C      UPSTREAM END OF TRAILING SL
 1318 IF(NREFIN+INRCTR-2) 1302,1319,1319
 1319 CALL STANO(M,L,UPPER)
      IF(TYPELB(L).NE.TE .AND. TYPEUB(L).NE.TE) GO TO 1302
      CALL STAX1(X1(L),X2(J),X2(J),LXB,LXA)
      BSQEXP(L)=BITS
      LW     = LWO
 1320 IF(LW.GE.LWE) GO TO 1328
      IF(X2W(LW).EQ.X2(J2)) GO TO 1324
      GO TO 1320
C     DST(LSTR)=T.E. PLUS B.L. THICKNESS
 1324 LSTR=LW+(LWNEXT(LW)-2)/2
      IF(DST(LSTR)) 1326,1328,1326
 1326 IF(UPPER) GO TO 1332
      GO TO 1340
C      SHARP T.E.
 1328 BSQEXP(L)=-1.
      IF(PTTE(LXA)-PTTE(LXB)) 1332,1336,1340
 1332 ANGEXP(L)=ANGTE(LXB)
      IF(LXB.NE.L) BSQEXP(L)=-1.
      LTSL   = LXB
      LSAV   = LXA
```

```
      GO TO 1342
 1336 ANGEXP(L)=.5*(ANGTE(LXB)+ANGTE(LXA))
      GO TO 1342
 1340 ANGEXP(L)=ANGTE(LXA)
      IF(L.NE.LXA) BSQEXP(L)=-1.
      LTSL  = LXA
      LSAV  = LXB
 1342 IF(PDUM(4)-2.) 1348,1344,1344
 1344 NBCB(1)=1
      FB(1) = ANGEXP(L)
      GO TO 1348
C       FIELD BOUNDARIES
 1346 NBCB(IEND)=NBCIN(IEND)
      FB(IEND)=ACF(IEND)
 1348 IF(IEND.EQ.1) GO TO 1302

C     DEFINE ANG(1)  TO OBTAIN CORRECT ANGLE BRANCH
  135 IF(IA.NE.1) GO TO 136
      ANG(1)= BRANCH(1)
      IF(BRANCH(1).NE.999.) GO TO 136
      L      = 0
      M      = MSV(1)
      CALL STANO(M,L,UPPER)
      IF(M.NE.MLB(L)) GO TO 1352
C       FIRST STREAMLINE
      LB     = LBF(NAMELB(L))
      LB     = LB+LBZ1(LB)
      ANG(1)= ANGBT(LB)
      GO TO 136
C       NOT FIRST STREAMLINE
 1352 M      = M-1
      IF(M.LT.MLB(L)) CALL ERROR1
      CALL GETIX
      IF(J2DONE(J).EQ.0) GO TO 1352
      ANG(1)= PHI1(M)
      IF(PDUM(19).EQ.1.) WRITE (6,1353)J,M,ANG(1)
 1353 FORMAT (8H J,M,ANG,2I6,F10.6)
  136 IF(ISTAGB.NE.1) GO TO 155

C     THE STREAMLINE IS TERMINATED BY A STAGNATION POINT.
C      PROCEED TO EXTRAPOLATE FOR ITS POSITION IF STAG=1
C      AND BOUNDARY TYPE=LE.

C     FIND THE STAGNATION POINT STATION
      L      = 0
      CALL STANO(MB,L,UPPER)

C     CHECK FOR LEADING EDGE POINT
      CURVD = 0.
      IF(UPPER) GO TO 138
      IF(TYPELB(L).NE.LE) GO TO 155
      GO TO 140
  138 IF(TYPEUB(L).NE.LE) GO TO 155

C     BEGIN ITERATION FOR STAGNATION POSITION
  140 QV(1) = 0.
      SMOVE = 0.
      M      = MB
      IF(ABS(PDUM(5)).LT.5.) FB(2)=1.
  145 IF(UPPER) GO TO 147
      NAMES = NAMELB(L)
```

```
      IBS    = ILB(L)
      FS     = FLB(L)
      S1S    = S1LB(L)
      GO TO 148
  147 NAMES  = NAMEUB(L)
      IBS    = IUB(L)
      FS     = FUB(L)
      S1S    = S1UB(L)
  148 CALL BDYPTM(NAMES,IBS,ZB(I),RB(I),FS,S1S,SMOVE,GETASK)
      IF(GETASK.EQ.0.) GO TO 1482
      WRITE (6,1148) J2,ZB(I),RB(I)
      CALL ERROR1
 1482 Z(M)   = ZB(I)
      R(M)   = RB(I)
      IRET   = 0
      GO TO 1551
C       (LOGIC FOR LEADING STAGNATION POINT ONLY)
  149 ERRANG= ANG(I)-(ANGD-PIO2)

      IF(PDUM(1).LE.0.) GO TO 150
      WRITE (6,1149) QV(1),SMOVE,ERRANG,ZB(I),RB(I),ANGD,CURVD
 1149 FORMAT(14H STAG PT - QV=F5.0,2X,6HSMOVE=F10.5,2X,7HERRANG=F10.6,2X
     +,3HZD=F10.5,2X,3HRD=F10.5,2X,5HANGD=F10.3,2X,6HCURVD=F10.6)
      GO TO 1501
  150 IF(CURVD.GE.0.) GO TO 1501
      WRITE (6,1150) ZB(I),RB(I),ANGD,CURVD

 1501 IF(PASS1) GO TO 156
      IF(QV(1).NE.0.) GO TO 151
      YO     = 0.
      YTOL   = 1.E-5
      DYDX   = ABS(CURVD) + 1./(S1B(I)-S1B(I-1))
      XJP    = -ABS(ERRANG)/DYDX
      DYDX   = 0.
  151 CALL QIREM(SMOVE,ERRANG, XJP,QV)
      IF(QV(1).NE.0.) GO TO 145
      IF(UPPER) GO TO 152
      ILB(L)= IBS
      FLB(L)= FS
      S1LB(L)=S1S
      GO TO 156
  152 IUB(L)= IBS
      FUB(L)= FS
      S1UB(L)=S1S
      GO TO 156

C     USE (SUBSONIC) BEAM FORMULA TO CALC ANG,CURVATURE,S1
C      SET IORDER=1 TO CHECK FOR POINT ORDERING
  155 IRET   = 1
 1551 NORDER= 1
 1552 IORDER= 1
      CALL BFACS(ZB,RB,ANG,CURVB,S1B, IA,IB)
      IF(IORDER.EQ.0) GO TO 1555
      I      = IORDER-1
      WRITE (6,1155) ZB(I),RB(I),ZB(I+1),RB(I+1),J2,I,IORDER
      IF(NORDER.GE.5) CALL ERROR1
      SAV    = ZB(I)
      ZB(I)  = ZB(I+1)
      ZB(I+1)=SAV
      SAV    = RB(I)
      RB(I)  = RB(I+1)
```

```
      RB(I+1)=SAV
      NORDER= NORDER+1
      GO TO 1552
 1555 IF(IRET) 1556,149,1556
 1556 IF(SSFML.EQ.(-1)) CALL BF3(ZB,RB,ANG,CURVB, IA,IB)
  156 IF(SSEF .AND. .NOT.PARSLA) ANG(1)=SSEANG*TORAD

C     RELOCATE ANSWERS INTO FIELD STORAGE
  160 M       = MA
      I       = IA-1
      L       = 0
  161 CALL GETIX
      IF(ISTAG.EQ.3) GO TO 166
      I       = I+1
C        SUPERSONIC POINT CURVATURE
         IF(B(M).GE.0. .OR. I.EQ.1) GO TO 163
         I1SS   = I-1-IABS(SSFML)
         NBCB(1)=0
         NBCB(2)=0
         FB(1) = SSFND1
         FB(2) = SSFEND
         IF(I1SS.GT.1) GO TO 1622
         I1SS   = 1
         NBCB(1)=2
         FB(1) = 0.
C          LOGIC FOR FIRST PT DOWNSTRM OF T.E.
 1622    IF((I-IA).NE.1 .OR. LTSL.EQ.0) GO TO 1629
         FGRX   = FGRTE(LTSL)
         FGTX   = 1./(FGRX+1.)
         GX     = FGRX+FGRX+1.
         BETSTE= BETSQ(PTTE(LTSL)/PSTE(LTSL))
         IF(BETSTE.LE.0.) GO TO 1629
         PMTE   = PM(BETSTE)
         PEXP   = PTTE(LSAV)
C          CHECK FOR T.E. BLUNTNESS
         IF(LW.GE.LWE) GO TO 1624
         IF(DST(LSTR).GT.0.) PEXP=PSTE(LSAV)
 1624    BSQEXP(LTSL)=BETSQ(PTTE(LTSL)/PEXP)
      IF(BSQEXP(LTSL).LE.0.) GO TO 1629
         DELPM = PM(BSQEXP(LTSL)) - PMTE
         ANGEXP(LTSL) = ANGTE(LTSL)+DELPM
         IF(LTSL.EQ.LXA) ANGEXP(LTSL)=ANGTE(LTSL)-DELPM
         IF(PDUM(4)-1.) 1629,1626,1626
 1626    FB(1) = ANGEXR(LTSL)
         NBCB(1)=1
         I1SS   = I-1
 1629    NISS   = I-I1SS+1
         CALL BFAC(ZB(I1SS),RB(I1SS),ANG(I1SS),CURSS,NISS)
         PHI1(M)=ANG(I)
         CURV(M)=CURSS(NISS)
         GO TO 164
  163 PHI1(M)=ANG(I)
      CURV(M)=CURVB(I)
      Z(M)    = ZB(I)
      R(M)    = RB(I)
      IF(I.NE.IA .OR. I.EQ.1) GO TO 164
      PHI1(M)=.5*(ANG(I)+ANGSAV)
      CALL BF3(ZB(I-1),RB(I-1),ANG(I-1),CURV(M-1),1,3)
      IF(ISTAG.NE.1) GO TO 164
      CALL STANO(M,L,UPPER)
      IF(TYPELB(L).NE.LE .AND. TYPEUB(L).NE.LE) GO TO 164
```

```
      ANGLE(L)=ANGD-PIO2
      CRVLE(L)=CURVD
  164 S1(M) = S1B(I)
      GO TO 168
C      INTERPOLATE CURVATURE AND LOCATION FOR  ISTAG=3  POINTS
  166 DR     = RB(I+1)-RB(I)
      DZ     = ZB(I+1)-ZB(I)
      CHD    = SQRT(DR*DR+DZ*DZ)
      CS     = DZ/CHD
      SN     = DR/CHD
      ACHD   = ATAN3(DR,DZ,ANG(I))
      F      = (CS*(Z(M)-ZB(I)) + SN*(R(M)-RB(I)))/CHD
      IF(F.GT.1. .OR. F.LT.0.) CALL ERROR1
      G      = 1.-F
      YPA    = ANG(I)-ACHD
      YPB    = ANG(I+1)-ACHD
      CALL BFI
      R(M)   = RB(I)+RM
      Z(M)   = ZB(I)+ZM
      PHI1(M)=ACHD+ANGM
      CURV(M)=CURVM
      S1(M) = S1B(I)+S1M
C 168 IF(I.GE.IB) GO TO 170
  168 IF(PDUM(1).LE.0.) GO TO 1690
      IF(PDUM(1).EQ.1.) GO TO 1680
      IF(PDUM(1).EQ.2. .AND. BI(I).LT.0.) GO TO 1680
      IF(PDUM(1).EQ.4. .AND. ISTAG.NE.0) GO TO 1680
      XJ2    = J2
      IF(PDUM(1).GE.5. .AND. XJ2.GE.PDUM(8) .AND. PDUM(1).GE.XJ2)
     * GO TO 1680
      GO TO 1690
 1680 WRITE(6,1161) I,M,ISTAG,Z(M),R(M),PHI1(M),CURV(M),CURVB(I),B(M)
 1159 FORMAT(1H1)
 1160 FORMAT (12H   I M ISTAG,5X,1HZ,9X,1HR,4X,4HPHI1,4X,4HCURV,3X,
     * 5HCURVB,9X,1HB,5H   J=,I3)
 1161 FORMAT (1X,I3,I4,I2,2F10.5,F8.4,2F8.5,F10.3)
 1690 IF(I.GE.IB) GO TO 170
      M      = MD
      GO TO 161

C     INDEX TO NEXT STREAMLINE SEGMENT
  170 IF(MD) 172,180,172
  172 IA     = IB
      MA     = M
C     I      = IB
      ANGSAV= ANG(I)
      CURSAV= CURVB(I)
C     (TRANSFER TO 126 RATHER THAN 120 SINCE 1ST POINT, I=IA=IB, IS SAVE
      GO TO 126

C     STREAMLINE  J2  HAS BEEN CURVE-FITTED,  INDEX J2 TO NEXT SL,
  180 J2DONE(J2)=1
    * ANYJ2 = .TRUE.
      GO TO 187
C      END CONDITION INTERPOLATION NOT POSSIBLE, BYPASS THIS SL
  186 ALLJ2 = .FALSE.
  187 J2     = J2+1
      IF(J2.LE.NJ) GO TO 101

C     GO BACK FOR 2ND, 3RD PASS TO INTERPOLATE FOR CURVATURE AT PARTIAL S
      IF(.NOT.ALLJ2) GO TO 100
```

```
C     S1-COORDINATE ON TOP OF T.E. IN /ADJWF/ FOR WAKE THICKNESS (TTPT)
      LF      = LFO
  301 IF(LF.GE.LFE) GO TO 402
      IF(JORDER(LF).LT.0) GO TO 320
      CALL STAX1(X1F(LF),-1.,X2F(LF),DUM,LXA)
      M       = MLB(LXA)
      S1F(LF)=S1(M)
  320 LF      = LF+NFCOLS
      GO TO 301

C     MODIFY WAKE TABLE FOR PROPER LENGTH
 402  IF(NREFIN+INRCTR) 404,900,404
 404  LF      = LFO
  406 IF(LF.GE.LFE) GO TO 900
      LW      = LWO
  410 IF(LW.GE.LWE) GO TO 430
      IF(X2W(LW).EQ.X2F(LF)) GO TO 420
      LW      = LW+LWNEXT(LW)
      GO TO 410
  420 IF(LWNEXT(LW).NE.8) GO TO 430
      CALL STAX1(X1F(LF),X2F(LF),X2F(LF),LXB,LXA)
      IF(NREFIN+INRCTR-2) 422,424,424
 422  BOT     = ANGTE(LXB)-ANGTB(LXA)
      F       = 1.
      GO TO 426
 424  IF(PDUM(3)) 425,422,425
 425  BOT     = ANGEXP(LXB)-ANGEXP(LXA)
      F       = PDUM(3)
 426  WLEN    = 2.*(DST(LW+3)-DST(LW+5))/AMAX1(BOT,.1)
      S1W(LW+2)=F*WLEN + (1.-F)*S1W(LW+2)
      S1W(LW+1)=.5*S1W(LW+2)
  430 LF      = LF+NFCOLS
      GO TO 406
  900 RZONLY= .TRUE.
      RETURN

 1148 FORMAT(*0***  ITERATION FOR STAG PT LOCATION (J=*I3,*)- ORTHOGONAL
     *ITY COND REQUIRES PT TO MOVE OFF THE BOUNDARY.*/
     ** ***  PRESENT LOCATION IS  Z=*F10.5,*   R=*F10.5,*   (SLC)*)
 1150 FORMAT(35H ***  NEGATIVE L.E. CURVATURE*   Z=F10.5,3X,2HR=F10.5,3
     *X,4HANG=F10.3,3X,5HCURV=F12.6)
 1155 FORMAT(29H *** SLC IS INTERCHANGING PTS,F11.5,1H,F10.5,6H   AND,F1
     *1.5,1H,F10.5,4H  J=I3,5H,   I=2I3)
      END
```

```
*DECK SPC
      SUBROUTINE SPC
*SPC---          SONIC POINT CURVATURE                            *SPC*

C     STATION TABLE
C      INDEX= L=LO,LESTA
C      SCHOKE= STATION CHOKE INDICATOR (ADJWF,BRWS,WRIOUT)
C      MCL    = SHARP CORNER INDICATOR (BLDTBS)
C      MCL    = FIELD INDEX OF CONTROL STREAMLINE (PTMOVE,FLOBAL)
      COMMON /CHDATA/ X1(1),LNEXT(1),MLB(1),MUB(1),PRIM(1),
     1                TYPELB(1),NAMELB(1),ILB(1),FLB(1),S1LB(1),
     1                TYPEUB(1),NAMEUB(1),IUB(1),FUB(1),S1UB(1),
     &                VMB(1),DWDV(1),X2CL(1),SLSWI(1),MCL(1),
     &                ANGTE(1),PTTE(1),PSTE(1),FGRTE(1),RGTE(1),
     &                ANGEXP(1),BSQEXP(475)
        DIMENSION      CRVLE(1),ANGLE(1)
        EQUIVALENCE    (SCHOKE,DWDV),(CRVLE,ANGTE),(ANGLE,PTTE)
        INTEGER        PRIM,TYPELB,TYPEUB,SCHOKE(1)

      COMMON /CB     / B(300)
      COMMON /CCURV  / CURV(300)
      COMMON /CIDEX  / M,J,MU,MD,ISTAG
      COMMON /CMAXIT/ MAXIT,MAJCTR,GREFIN,TL
      COMMON /CR     / R(300)
      COMMON /CS2    / S2(300)
      COMMON /CSS    / SSFML,SSEF,SSEANG,SSDF,SSFEND,SSFND1,
     &                DSS(4),TSIC,RHOC,RHOCSS
       INTEGER        SSFML
       LOGICAL              SSEF,       SSDF
      COMMON /CVM    / VM(300)
      COMMON /CZ     / Z(300)
      COMMON /IXORIG/ LHO,LHE, LBDO,LBDE, LTO,LTE, LWO,LWE, LFO,LFE,
     *                LO,LESTA,LSO,LSE,LDUM(6),
     *                MO,NM, NJ,NFCOLS, MAXNJ,MAXOL,MAXNM,MAXLE,
     *                LEO,LEE, LRO,LRE,LRD
      COMMON /SLTAB / W(128),X2(128),SLCHN(128)
       INTEGER        SLCHN

      DATA BELOW/5HBELOW/, ABOVE/5HABOVE/

C     BEGIN LOOP THROUGH STATIONS
      L      = LO

C     CONVERT STAG PT FROM SOFT TO HARD (I.E. SET ADJACENT ISTAG TO 3)
C       WHEN STAG VELOCITY IS LESS THAN HALF ADJACENT VELOCITY.
   20 M      = MLB(L)
      MINC   = 1
      SIDE   = ABOVE
   22 CALL GETIX
      IF(ISTAG-1) 36,24,36
   24 IF(MAJCTR) 26,36,26
   26 MSV    = M
      M      = M+MINC
      CALL GETIX
      IF(ISTAG-3) 28,36,28
   28 IF(VM(MSV)-.5*VM(M)) 30,35,35
   30 VM(MSV)= 0.
      ISTAG  = 3
      CALL SAVIX
      WRITE (6,1034) SIDE,Z(MSV),R(MSV)
      GO TO 36
   35 M      = MSV
```

```
 36  IF(MINC) 38,37,37
 37  MA     = M

     M      = MUB(L)
     MINC   = -1
     SIDE   = BELOW
     GO TO 22
 38  MB     = M

C    RECOMPUTE NEAR SONIC PT CURVATURES BY LINEAR INTERPOLATION
C    LOCATE SONIC POINT
  50 IF(TSIC.EQ.0. .OR. SLSWI(L).EQ.0.) GO TO 140
     M      = MA+1
  60 IF((B(M)*B(M-1)).GE.0.) GO TO 65
     CALL GETIX
     IF(W(J).NE.0.) GO TO 70
  65 M      = M+1
     IF(M.GT.MB) GO TO 140
     GO TO 60

C    F      = FRACTIONAL DISTANCE TO SONIC LINE ABOVE PT (M-1)
  70 F      = B(M-1)/(B(M-1)-B(M))

C    CALCULATION - INTERPOLATION JUNCTURE POINTS
     DFX    = AMIN1(TSIC,AMIN1(FLOAT(M-1-MA)+F,FLOAT(MB-M+1)-F))
     FX1    = F-DFX
     FX2    = F+DFX
     MX1    = M
     MX2    = M
  80 IF(FX1.GE.0. .OR. (MX1-1).LE.MA) GO TO 90
     MX1    = MX1-1
     FX1    = FX1+1.
     GO TO 80
  90 IF(FX2.LE.1. .OR. MX2.GE.MB) GO TO 100
     MX2    = MX2+1
     FX2    = FX2-1.
     GO TO 90
 100 SX1    = S2(MX1-1)+FX1*(S2(MX1)-S2(MX1-1))
     SX2    = S2(MX2-1)+FX2*(S2(MX2)-S2(MX2-1))

C    CALCULATE LINEAR VARIATION OF CURVATURE BET JUNCTURE PTS
     CX1    = CURV(MX1-1)+FX1*(CURV(MX1)-CURV(MX1-1))
     CX2    = CURV(MX2-1)+FX2*(CURV(MX2)-CURV(MX2-1))
     MX     = MX1
 120 IF(MX.GE.MX2) GO TO 65
     CURV(MX)=(CX1*(SX2-S2(MX))+CX2*(S2(MX)-SX1))/(SX2-SX1)
     MX     = MX+1
     GO TO 120

C    INDEX TO THE NEXT STATION
 140 L      = L+LNEXT(L)
     IF(L.LT.LESTA) GO TO 20

     RETURN

1034 FORMAT(26X,24HISTAG=3  POINT INSERTED ,A5,18H L.E. OR CORNER AT,
    + 2F11.5)
     END
```

```
*DECK STTOFI
      SUBROUTINE STTOFI(L1,MD1)
*STTOFI          ADJUST THE STATION-TABLE POINTERS               *STTOFI*
C                TO THE FIELD-TABLE UPWARD BY  MD1

C     INPUT-
C      L1     = FIRST STATION FOR WHICH POINTERS  MUB(L),MLB(L)  MUST BE A
C      MD1    = INCREMENT TO BE ADDED TO MLB(L) AND MUB(L).
C               MUB(L),MLB(L)  POINT TO THE FIELD-TABLE

C     STATION TABLE
C      INDEX- L=LO,LESTA
C      SCHOKE= STATION CHOKE INDICATOR (ADJWF,BRBS,WRIOUT)
C      MCL    = SHARP CORNER INDICATOR (BLDTBS)
C      MCL    = FIELD INDEX OF CONTROL STREAMLINE (PTMOVE,FLOBAL)
      COMMON /CHDATA/ X1(1),LNEXT(1),MLB(1),MUB(1),PRIM(1),
     1                TYPELB(1),NAMELB(1),ILB(1),PLB(1),S1LB(1),
     1                TYPEUB(1),NAMEUB(1),IUB(1),PUB(1),S1UB(1),
     &                VMB(1),DWDV(1),X2CL(1),SLKWT(1),MCL(1),
     &                ANGTE(1),PTTE(1),PSTE(1),EGRTE(1),RGTE(1),
     &                ANGEXP(1),BSQEXP(475)
         DIMENSION    CRVLE(1),ANGLE(1)
         EQUIVALENCE  (SCHOKE,DWDV),(CRVLE,ANGTE),(ANGLE,PTTE)
         INTEGER      PRIM,TYPELB,TYPEUB,SCHOKE(1)
      COMMON /IXORIG/ LHO,LHE, LBDO,LBDE, LTO,LTE, LWO,LWE, LFO,LFE,
     &                LO,LESTA, LSO,LSE, LDO,LDE, LDUM(4),
     &                MO,NM,NJ,NFCOLS, MAXNJ,MAXOL, MAXNM,MAXLE,
     &                LEO,LEE, LRO,LRE,LRD
      COMMON /CBITS / BITS,BLANK

      L      = L1
      MD     = MD1
      MUB(L)= MUB(L)+MD
      IF((MUB(L)-MLB(L)).LT.MAXOL) GO TO 60
      CALL ERROR1
   60 L      = L+LNEXT(L)
      IF(L.GE.LESTA) GO TO 900
      MLB(L)= MLB(L)+MD
      MUB(L)= MUB(L)+MD
      GO TO 60

  900 RETURN
      END
```

```
*DECK STCM
      OVERLAY(STC,4,0)
      PROGRAM STCM
      COMMON /CPRINT/  PPDUM(6),PDUM(20)
      CALL MCOEF
      CALL IAD
      RETURN
      END
```

```
*DECK USECDM
      BLOCK DATA USECDM
*USECDM          REPLACE STGM USE CARDS
      COMMON /CA2   / A2(768)
      COMMON /CA3   / A3(768)
      COMMON /CA4   / A4(768)
      COMMON /CA5   / A5(768)
      COMMON /CA6   / A6(768)
      COMMON /CA7   / A7(768)
      COMMON /CA8   / A8(768)
      END
```

```
*DECK ERRORM
      SUBROUTINE ERROR1
CEDUMPM         EDUMP FOR STCM LINK

C     STATION TABLE
C      INDEX= L=LO,LESTA
C      SCHOKE= STATION CHOKE INDICATOR (ADJWF,BRHS,WRIOUT)
C      MCL   = SHARP CORNER INDICATOR (BLDTBS)
C      MCL   = FIELD INDEX OF CONTROL STREAMLINE (PTMOVE,FLOBAL)
      COMMON /CHDATA/ X1(1),LNEXT(1),MLB(1),MUB(1),PRIM(1),
     1                TYPELB(1),NAMELB(1),ILB(1),FLB(1),S1LB(1),
     1                TYPEUB(1),NAMEUB(1),IUB(1),FUB(1),S1UB(1),
     &                VMB(1),DWDV(1),X2CL(1),SLSWI(1),MCL(1),
     &                ANGTE(1),PTTE(1),PSTE(1),FGRTE(1),RGTE(1),
     &                ANGEXP(1),BSQEXP(475)
      DIMENSION       CRVLE(1),ANGLE(1)
      EQUIVALENCE     (SCHOKE,DWDV),(CRVLE,ANGTE),(ANGLE,PTTE)
      INTEGER         PRIM,TYPELB,TYPEUB,SCHOKE(1)

C     TABLE OF INDEX LIMITS
      COMMON /IXORIG/ LHO,LHE, LBDO,LBDE, LTO,LTE, LWO,LWE, LFO,LFE,
     *                LO,LESTA,LSO,LSE,LDO,LDE,LDUM(4),
     *                MO,NM, NJ,NFCOLS, MAXNJ,MAXOL,MAXNM,MAXLE,
     *                LEO,LEE, LRO,LRE,LRD
      DIMENSION       LIMITS(24)
      EQUIVALENCE     (LIMITS,LHO)
C     STREAMLINE TABLE
      COMMON /SLTAB / W(128),X2(128),SLCHN(128)
      INTEGER SLCHN
      COMMON /CA2   / A2(300)
      COMMON /CA3   / A3(300)
      COMMON /CA4   / A4(300)
      COMMON /CA5   / A5(300)
      COMMON /CA6   / A6(300)
      COMMON /CA7   / A7(300)
      COMMON /CA8   / A8(300)
      COMMON /CB    / B(300)
      COMMON /CCURV / CURV(300)
      COMMON /CDS2  / DS2(300)
      COMMON /CDDS2 / DDS2
      COMMON /CFB   / L,MA,MB,PLB,PUB,WF,CHOKE,SUBSON, NK,PLBC,PUBC,
     1                XCHOKE, TAREA,VMBC, WROST,WCALC, QV(8),QVP(8),
     *                JSUM,VMLBSQ
      LOGICAL                                CHOKE,SUBSON
      COMMON /CIDEX / M,J,MU,MD,ISTAG
      COMMON /CIDEXR/ C2(25)
      COMMON /CPHI1 / PHI1(300)
      COMMON /CR    / R(300)
      COMMON /CRHS  / RHS(300)
      COMMON /CS1   / S1(300)
      COMMON /CS2   / S2(300)
      COMMON /CTABPR/ I1TAB
      COMMON /CTOLRL/ C3(12)
      COMMON /CVM   / VM(300)
      COMMON /CZ    / Z(300)
      COMMON / CLINES / LINES, OMITFK, PTITLE(6)
      LOGICAL           OMITFK
      COMMON /BLBDY / IBLB(60)

      CALL TABPRT(3HCFB,L,33,4)
      CALL TABPRT(5HCIDEX,M,5,5)
      CALL TABPRT (6HCIDEXR,C2,25,5)
```

```
      CALL TABPRT (6HCTOLRL,C3,6,6)
      I1TAB  = LQ
      CALL TABPRT (6HSTATAB,X1,LESTA,5)
      OMITFK = .TRUE.
      LINES = 64
      CALL FHEAD(NM)
      WRITE ( 6,1200 )
      DO 50 M=1,NM
      CALL GETIX
      WRITE ( 6,1201 ) J, M, MU, MD, ISTAG, S1(M), S2(M), Z(M), R(M),
     1 PHI1(M), CURV(M), VM(M)
   50 CONTINUE

      WRITE (6,1000)
      DO 100 I=1,NM
      WRITE (6,1001) I,B(I),A2(I),A3(I),A4(I),A5(I),A6(I),A7(I),A8(I),
     1               DS2(I),RHS(I)
  100 CONTINUE
      WRITE (6,1002) DDS2
 1000 FORMAT (4H1  M,11X,1HB,10X,2HA2,10X,2HA3,10X,2HA4,10X,2HA5,10X,
     1        2HA6,10X,2HA7,10X,2HA8,9X,3HDS2,9X,3HRHS)
 1001 FORMAT (1H ,I3,8F12.3,2F12.6)
 1002 FORMAT(///8H  DS2MX=,F12.6)
 1200 FORMAT (57X,16HFIELD TABLE DUMP/98H   J     M    MU    MD I    S1
     1     S2               Z               R              PHI1        CURV                V
     2M)
 1201 FORMAT (1X,I3,3I5,I2,2F11.6,2F12.6,F11.6,F12.7,F11.3)
      IF( IBLB(1).NE.0 ) CALL TABPRT(5HBLBDY,IBLB,60,3)
      IF( LDE.EQ.0 ) GO TO 1321
      I1TAB = LDO
      CALL TABPRT(5HBLTAB,CHNAM,LDE,3)
 1321 CONTINUE
      LSTOP = 5
      GO TO (999,999) , LSTOP
  999 RETURN
      END
```

```
*DECK MCOEF
      SUBROUTINE MCOEF
*MCOEF*         MATRIX COEFFICIENT                                  *MCOEF*

C     INPUT*
C      W(J)   = SL FLOW
C      S1(M)  = DISTANCE ALONG STREAMLINES
C      B(M)   = COEFFICIENT OF THE CURVATURE TERM
C      STATION TABLE

C     OUTPUT*
C      A1(M),A2(M),..,A8(M) = MATRIX COEFICIENT ARRAYS         M=1,NM

C            STAR ARRANGEMENT IS -
C                                                   A8
C                         A1       A2       A3      A4       A5       A6
C                                                   A7

C      NOTE -  A4 IS ALWAYS NEGATIVE EXCEPT FOR THE FIRST OF DOUBLE POINT
C              THEN A4(M)=1., A8(M)=-1.

      COMMON /ALLCOM/ MACHA,PSA,TSA,PTA,TTA, AXIA,RGA,GAMA,
     &                MACHC,PSC,TSC,PTC,TTC, AXIC,RGC,GAMC,
     &                DAXIT,SCALEA,TTE,CHOTST
       REAL           MACHA(1),MACHC
       LOGICAL        AXIA,AXIC
       LOGICAL        CHOTST
      COMMON /BENDIN/ NBCIN(2),ACF(2)
      COMMON /CA2   / A2(300)
      COMMON /CA3   / A3(300)
      COMMON /CA4   / A4(300)
      COMMON /CA5   / A5(300)
      COMMON /CA6   / A6(300)
      COMMON /CA7   / A7(300)
      COMMON /CA8   / A8(300)
       DIMENSION      A0(300),A1(300)
       EQUIVALENCE    (A0,A6),(A1,A5)
      COMMON /CATM  / NX,XDIM,G(25)
      COMMON /CB    / B(300)
      COMMON /CBITS / BITS,BLANK
      COMMON /CCUBE / NBC(2),C1(2),C2(2),FEND(2)
      COMMON /CCURV / CURV(300)
      COMMON /CFB   / L,MA,MB,DFB(30)
      COMMON /CFFINC/ GFF(6)
      COMMON /CFRFIN/ ATINF
      COMMON /CIDEX / M,J,MU,MD,ISTAG
      COMMON /CMAXIT/ MAXREF,NREFIN
      COMMON /CPI   / PI,TWOPI,PIO2,PIO4,TODEG,TORAD
      COMMON /CPRINT/ PDD(6),RDUM(10)
      COMMON /CPTMOV/ DPTMOV(2),NODENS
      COMMON /CR    / R(300)
      COMMON /CRHS  / RHS(300)
      COMMON /CS1   / S1(300)
      COMMON /CSS   / SSFML,SSEF,SSEANG,SSDF,SSFEND,SSFND1,
     &                DSS(2),RHOW,RHOWSS,TSIC,RHOC,RHOCSS
       INTEGER        SSFML
       LOGICAL              SSEF,        SSDF
      COMMON /CTHICK/ NTHKX,DUMTH(301)
      COMMON /CVM   / VM(300)
      COMMON /CXG   / X(6)
      COMMON /CZ    / Z(300)
      COMMON /ERASE2/ IADUSE(768),LAM(96)
```

```
       REAL                LAM
       COMMON /IXORIG/ LHO,LHE, LBDO,LBDE, LTO,LTE, LWO,LWE, LFO,LFE,
     &                 LO,LESTA,LSO,LSE,LDUM(6),
     &                 MO,NM, NJ,NFCOLS, MAXNJ,MAXOL,MAXNM,MAXLE,
     &                 LEO,LEE, LRO,LRE,LRD
       COMMON /SLTAB / W(128),X2(128),SLCHN(128)
        INTEGER        SLCHN
C     STATION TABLE
C      INDEX= L=LO,LESTA
C      SCHOKE= STATION CHOKE INDICATOR (ADJWF,BRHS,WRIOUT)
C      MCL    = SHARP CORNER INDICATOR (BLDTBS)
C      MCL    = FIELD INDEX OF CONTROL STREAMLINE (PTMOVE,FLOBAL)
       COMMON /CHDATA/ X1(1),LNEXT(1),MLB(1),MUB(1),PRIM(1),
     1                 TYPELB(1),NAMELB(1),ILB(1),FLB(1),S1LB(1),
     1                 TYPEUB(1),NAMEUB(1),IUB(1),FUB(1),S1UB(1),
     &                 VMB(1),DWDV(1),X2CL(1),SLSWI(1),MCL(1),
     &                 ANGTE(1),PTTE(1),PSTE(1),FGRTE(1),RGTE(1),
     &                 ANGEXP(1),BSQEXP(475)
        DIMENSION      CRVLE(1),ANGLE(1)
        EQUIVALENCE    (SCHOKE,DWDV),(CRVLE,ANGTE),(ANGLE,PTTE)
        INTEGER        PRIM,TYPELB,TYPEUB,SCHOKE(1)


       INTEGER         FIELD,FREE,FARFLD,PRES,OLBC
       LOGICAL         SLBDY,SUBDY

       DATA FIELD/5HFIELD/
       DATA FREE/4HFREE/, FARFLD/6HFARFLD/, PRES/4HPRES/, OLBC/4HOLBC/


C     BEGIN LOOP THROUGH THE STATIONS
       L       = LO

C     BEGIN LOOP ACROSS THE STREAMLINES
  800 MA      = MLB(L)
      MB      = MUB(L)
      NK      = MB-MA+1
      CALL SETM(1,1,LAM,NK)
      IF(NTHKX.GT.1) CALL LFIT2D(Z(MA),R(MA),LAM,NK)
      MAM1    = MA-1
      M       = MA
  810 A2(M) = 0.
      A3(M) = 0.
      A4(M) = 0.
      A5(M) = 0.
      A6(M) = 0.
      A7(M) = 0.
      A8(M) = 0.
      MCENTR= M

C     INITIALIZE /CCUBE/ FOR CUFITR
      C1(1) = 0.
      C1(2) = 0.
      C2(1) = 0.
      C2(2) = 0.


C     CHECK FOR SPECIAL (FREE,PRES, OR FARFLD) BOUNDARY
       SLBDY = .FALSE.
       SUBDY = .FALSE.
```

```
      IF(M.NE.MA) GO TO 820
      IF(NODENS.GE.NREFIN) GO TO 818
      IF(TYPELB(L).EQ.FREE  .OR.
     &   TYPELB(L).EQ.FARFLD .OR.
     &   TYPELB(L).EQ.FIELD .OR.
     &   TYPELB(L).EQ.DLBG  .OR.
     &   TYPELB(L).EQ.RRES) SLBDY=.TRUE.
  818 IF(.NOT.SLBDY) GO TO 825
  820 IF(M.NE.MB) GO TO 826
      IF(NODENS.GE.NREFIN) GO TO 822
      IF(TYPEUB(L).EQ.FREE  .OR.
     &   TYPEUB(L).EQ.FARFLD .OR.
     &   TYPEUB(L).EQ.FIELD .OR.
     &   TYPEUB(L).EQ.DLBG  .OR.
     &   TYPEUB(L).EQ.RRES) SUBDY=.TRUE.
  822 IF(SUBDY) GO TO 826

C     SOLID WALL BOUNDARY
  825 A4(M) = -1.
      GO TO 980

C     INTERIOR POINT
C     BUILD X-TABLE OF DISTANCES TO NEIGHBORING POINTS ALONG THE STREAMLI
C       POINTS WITH ISTAG=3 ARE TO BE OMITTED.
C       SPECIAL END CONDITIONS ARE TO BE UTILIZED IF THE X-TABLE IS TERMI
C       BY A STAGNATION POINT
  826 CALL GETIX
      JCENTR= J
      ISTAGC= ISTAG
      X(4)   = S1(M)
      IC1    = 4
      IC2    = 4
      NBC(1)= 2
      NBC(2)= 2
      C2(1) = 0.
      C2(2) = 0.
      MDOWN = MD

  831 M      = MU
      IF(M.EQ.0) GO TO 850
      CALL GETIX
      IF(ISTAG.EQ.3) GO TO 831
      X(3)   = S1(M)
      IC1    = 3
      IF(ISTAG.NE.0) GO TO 850
      IF( SSFML.LT.0 .AND. B(MCENTR).GE.0. .AND. PDUM(12).EQ.(-1.) )
     &        GO TO 850

  841 M      = MU
      IF(M.EQ.0) GO TO 850
      CALL GETIX
      IF(ISTAG.EQ.3) GO TO 841
      X(2)   = S1(M)
      IC1    = 2

  846 IF( B(MCENTR).GT.0. ) GO TO 850
        IF(IABS(SSFML).EQ.1 ) GO TO 850
      M      = MU
      IF(M.EQ.0) GO TO 850
      CALL GETIX
      IF(ISTAG.EQ.3) GO TO 846
```

```
      X(1)   = S1(M)
      IC1    = 1
C     UPSTREAM STREAMLINE END CONDITION
  850 IF(MU) 854,852,854
  852 NBC(1)= NBCIN(1)
      FEND(1)=ACF(1)
C     DOWNSTREAM POINTS, BYPASS FOR SUPERSONIC FLOW
  854 IF(B(MCENTR).LE.0.) GO TO 874
      MD     = MDOWN
  856 M      = MD
      IF(M.EQ.0) GO TO 870
      CALL GETIX
      IF(ISTAG.EQ.3) GO TO 856
      X(5)   = S1(M)
      IC2    = 5
      IF(ISTAG.NE.0) GO TO 865
      IF( SSFML.LT.0 .AND. PDUM(12).EQ.(-1.) ) GO TO 865

  861 M      = MD
      IF(M.EQ.0) GO TO 870
      CALL GETIX
C     IF(B(M).LE.0. .AND. B(MU).LE.0.) GO TO 874
      IF(ISTAG.EQ.3) GO TO 861
      X(6)   = S1(M)
      IC2    = 6
C     SPECIAL DOWNSTREAM END CONDITIONS FOR LEADING EDGE STAGNATION POINT
  865 IF(ISTAG.NE.1) GO TO 870
      NBC(2)= 4
      LL     = 0
      CALL STANO(M,LL,UPPER)
      C1(2) = CRVLE(LL)
      FEND(2)=1.
      IF(ABS(PDUM(5)).GE.5.) FEND(2)=0.
C     DOWNSTREAM STREAMLINE END CONDITIONS
  870 IF(MD) 878,872,878
  872 NBC(2)= NBCIN(2)
      FEND(2)=ACF(2)
      GO TO 878
C     BOUNDARY CONDITION ON 4-POINT SUPERSONIC BEAM-CURVATURE FORMULA
  874 FEND(2)=SSFEND
      FEND(1)=SSFND1
      NBC(2)= 0
      NBC(1)= 0
C     CALL CUBER TO OBTAIN SECOND ORDER DIFFERENCE FORMULA, D2(DN)/D(S1)2
C      ANSWERS ARE STORED IN  G(IG,JG), JG=1,IC2-IC1+1, IG=MID POINT
  878 NIC    = IC2-IC1+1
      IF(ISTAGC.EQ.3) GO TO 880
      IF(NIC.LE.2) GO TO 906
      CALL CUBERS(X(IC1),NIC)
      GO TO 900
C     CALL CUFITR FOR INFLUENCE COEFFICIENTS, DS2(3)=F(DS2(1),DS2(2),DS(4
C       FOR INFIELD BOUNDARY POINT(ISTAG=3)
  880 CALL CUFITR(X(IC1),NIC,5-IC1)
```

```
C****DEFINE ALL COEFFICIENTS OF THE EQUATION FOR FIELD POINT M
C      IG     = 4-IC1+1
C      JG     = IC-IC1+1
C      IJG    = (JG-1)*5 + IG
C      IJG    = CENTER POINT INDEX IN G-ARRAY
  900 IJG     = 25-IC1*6
      IF(PDUM(5).LE.0.) GO TO 904
      IF(ISTAGC.NE.3 .AND. PDUM(5).EQ.3.) GO TO 904
      IF(PDUM(5).GE.4. .AND. NBC(2).NE.4) GO TO 904
      WRITE (6,1904) JCENTR,MCENTR,IC1,IC2,IJG
 1904 FORMAT(//3H J=I3,9H  MCENTR=I3,7H   IC1=I3,7H   IC2=I3,6H  IJG=I3)
      CALL TABPRT(1HX,X(IC1),NIC,5)
      CALL TABPRT(5HCCUBE,NBC,8,8)
      CALL TABPRT(1HG,G,25,5)
  904 CONTINUE

C     SET CORRECTION EQ DECELERATION FACTORS
  906 M       = MCENTR
      IF(B(M).LT.0.) GO TO 908
      RHOWW = RHOW
      BUSE  = RHOC*B(M)
      GO TO 909
  908 RHOWW = RHOWSS
      BUSE  = RHOCSS*B(M)

C     CHECK FOR INFIELD BOUNDARY POINT OR SPECIAL BOUNDARY
  909 IF(.NOT.SLBDY .AND. .NOT.SUBDY .AND. ISTAGC.NE.3) GO TO 910
      GO TO 926

C     FIRST POINT OF A DOUBLE SL, CHECK  W(JCENTR+1)
  910 M       = MCENTR+1
      CALL GETIX
      IF(W(J).NE.0.) GO TO 915
      M       = MCENTR
      J       = JCENTR
      GO TO 926

C     POINTS 7, 8, AND 4
  915 JP      = J
      MP      = M
      JM      = JCENTR
      M       = MCENTR-1
      IF(W(JCENTR).NE.0.) GO TO 920
      CALL GETIX
      JM      = J
      M       = MCENTR-2
  920 CALL GETIX
      MM1     = M
      JM1     = J
      M       = MCENTR
      J       = JCENTR

      A7(M) = RHOWW/(W(JM)-W(JM1))
      A8(M) = RHOWW/(W(JP)-W(J))
      K     = M-MAM1
      A4(M) = LAM(K)*(-A7(M)-A8(M))
      A8(M) = LAM(K+1)*A8(M)
      K     = MM1-MAM1
      A7(M) = LAM(K)*A7(M)
      IF(.NOT.AXIA) GO TO 926
      A4(M) = TWOPI*R(M)*A4(M)
```

```
      A7(M) = TWOPI*R(MM1)*A7(M)
      A8(M) = TWOPI*R(M+1)*A8(M)

C     POINTS 1, 2, 3, 4, 5, AND 6
  926 IF(NIC.LE.2) GO TO 938
      IF(IC1.NE.0 ) GO TO 930
  930 GO TO (931,932,933,934),IC1
  931 A1(M) = BUSE*G(IJG-15)
  932 A2(M) = BUSE*G(IJG-10)
  933 A3(M) = BUSE*G(IJG-5)
  934 A4(M) = BUSE*G(IJG)+A4(M)
      IF(IC2-5) 938,935,936
  936 A6(M) = BUSE*G(IJG+10)
  935 A5(M) = BUSE*G(IJG+5)

C     MODIFY INFLUENCE COEFFICIENTS TO ACCOMMODATE DOUBLE STREAMLINE
C      MX     = DUMMY POINT
C      MT     = TRUE POINT
C      MX IS THE FIRST POINT, EXCEPT FOR CASC PROG WITH UPPER OLBC,
C      THEN MX IS THE SECOND POINT.
  938 IF(W(J).NE.0. .OR.SLBDY) GO TO 940
      MT     = M
      MX     = M-1
      IF(TYPEUB(L).NE.OLBC) GO TO 9392
      MT     = M-1
      MX     = M
 9392 IF(ISTAGC .EQ. 3) GO TO 9394
      A2(MT)= A2(M)+A2(M-1)
      A3(MT)= A3(M)+A3(M-1)
      A4(MT)= A4(M)+A4(M-1)
      A5(MT)= A5(M)+A5(M-1)
      A6(MT)= A6(M)+A6(M-1)
      IF(MX.NE.M) GO TO 9394
C       MX=M   AND   MT=M-1
      A7(M-1)=A7(M)
      A8(M-1)=A8(M)
      RHSV   = RHS(M-1)
      RHS(M-1)=RHS(M)
      A7(M) = -1.
      A8(M) = 0.
      RHS(M)= -RHSV
      GO TO 9396
 9394 A7(MX)= 0.
      A8(MX)= -1.
 9396 A2(MX)= 0.
      A3(MX)= 0.
      A4(MX)= 1.
      A5(MX)= 0.
      A6(MX)= 0.

C     FREE, PRESSURE AND FAR-FIELD BOUNDARIES
C       LOWER BOUNDARY
  940 IF(ISTAGC.EQ.3) GO TO 980
      IF(.NOT.SLBDY) GO TO 950
      IF(.NOT.AXIA) GO TO 942
      A4(M) = A4(M)-TWOPI*R(M)*LAM(1)
      A8(M) = TWOPI*R(M+1)*LAM(2)
      GO TO 980
  942 A4(M) = A4(M)-LAM(1)
      A8(M) = LAM(2)
      IF(TYPELB(L).NE.FARFLD) GO TO 980
```

```
C     STAREA= STREAM TUBE AREA
      STAREA= R(M+1)-R(M)
      IF(AXIA) STAREA=RI*(R(M)+R(M+1))*STAREA
  945 CALL FFINC
      VQATSQ= VM(M)*VM(M)/(ATINF*ATINF)
      BETA   = 1.-VQATSQ/(1.-.2*VQATSQ)
      IF(BETA.GT.0.) GO TO 947
      WRITE (6,1946) M
      CALL ERRORS
  947 BETA   = SQRT(BETA)
      BA     = BETA*STAREA
      A2(M)  = A2(M)-BA*GFF(2)
      A3(M)  = A3(M)-BA*GFF(3)
      A4(M)  = A4(M)-BA*GFF(4)
      A5(M)  = A5(M)-BA*GFF(5)
      A6(M)  = A6(M)-BA*GFF(6)
      GO TO 980
C      UPPER BOUNDARY
  950 IF(.NOT.SUBDY) GO TO 980
      K      = M-MAM1
      IF(AXIA) GO TO 964
      A4(M)  = A4(M)-LAM(K)
      A7(M)  = LAM(K-1)
      GO TO 966
  964 A4(M)  = A4(M)-TWOPI*R(M)*LAM(K)
      A7(M)  = TWOPI*R(M-1)*LAM(K-1)
  966 IF(TYPEUB(L).NE.FARFLD) GO TO 980
      STAREA= R(M)-R(M-1)
      IF(AXIA) STAREA=RI*(R(M)+R(M-1))*STAREA
      GO TO 945

  980 M      = MCENTR+1
      IF(M.LE.MB) GO TO 810
C.....END LOOP ACROSS THE STREAMLINES

C    INDEX TO NEXT STATION
      L      = L+LNEXT(L)
      IF(L.LT.LESTA) GO TO 800
C.....END LOOP THROUGH THE STATIONS
      RETURN

 1946 FORMAT(76H ***  SORRY - SUPERSONIC VELOCITY ENCOUNTERED ON FAR FIE
     &LD BOUNDARY AT POINT, I5, 9H  (MCOEF))
      END
```

```
*DECK ATDMRS
      SUBROUTINE ATDMRS
*ATDMRS         AUGUMENTED TRIDIAGONAL MATRIX REDUCTION     *ATDMRS*
C               SMALL MATRIX VERSION

C     GIVEN THE MATRIX EQUATION  AX=BY,
C      FIND  G  SO THAT  X=GY,
C      NOTE  X  AND  Y  ARE VECTORS,

C     INPUT-
C      A     - TRIDIAGONAL COEFFICIENT MATRIX OF X
C      B     = TRIDIAGONAL COEFFICIENT MATRIX OF Y (STORED IN G-ARRAY)
C               (OTHER OFF-DIAGONAL ELEMENTS MUST BE INITIALIZED TO ZERO)
C      IDIM  - FIRST SUBSCRIPT DIMENSION OF MATRIX  B  AND  G
C      N     - ORDER OF MATRACIES

C     ORDER OF STORAGE IS ILLUSTRATED BY-
C       A(2,1)  A(3,1) (A(1,1))           B(1,1)  B(1,2)
C       A(1,2)  A(2,2)  A(3,2)            B(2,1)  B(2,2)  B(2,3)
C               A(1,3)  A(2,3)  A(3,3)            B(3,2)  B(3,3)  B(3,4)
C              (A(3,4)) A(1,4)  A(2,4)                    B(4,3)  B(4,4)

C      OFF DIAGONAL ELEMENTS OF B MUST BE SET TO ZERO

C     OUTPUT-
C      G     = INVERSE(A) * B

      COMMON /ERASE / A(3,100), DUM(500)
      COMMON /CATM  / N,IDIM,G(25)

C*** FORWARD REDUCTION
      A(3,1)= A(3,1)/A(2,1)
      G(1)  = G(1)/A(2,1)
      G(IDIM+1)=G(IDIM+1)/A(2,1)
      I     = 2

C       SPECIAL LOGIC FOR INCLUDING  A(4,1)  WHICH IS STORED IN  A(1,1)
      A(1,1)= A(1,1)/A(2,1)
      QA2I  = 1./(A(2,2)-A(1,2)*A(3,1))
      A(3,2)= QA2I*(A(3,2)-A(1,2)*A(1,1))
      GO TO 97

   90 QA2I  = 1./(A(2,I)-A(1,I)*A(3,I-1))
   95 A(3,I)= QA2I*A(3,I)
   97 J     = 1
      IJ    = I
  120 G(IJ) = QA2I*(G(IJ)-A(1,I)*G(IJ-1))
      IF(J-I) 140,140,160
  140 IF(J-N) 150,160,160
  150 J     = J+1
      IJ    = IJ+IDIM
      GO TO 120
  160 IF(I-N) 170,180,170
  170 I     = I+1

C       SPECIAL LOGIC FOR INCLUDING A(N,N-2) WHICH IS STORED IN A(3,N)
      IF(I-N) 90,172,172
  172 A(1,I)= A(1,I)-A(3,I)*A(3,I-2)
      J     = 1
      IJ    = I
  178 G(IJ) = G(IJ)-A(3,I)*G(IJ-2)
  179 J     = J+1
```

```
      IJ      = IJ+IDIM
      IF(J-I)178,90,90

C*** BACK SUBSTITUTION
  180 I       = I-1
C     IF(I) 900,900,190
  190 J       = 1
      IJ      = I

C      SPECIAL LOGIC FOR INCLUDING  A(4,1)  WHICH IS STORED IN  A(1,1)
  192 IF(I-1) 900,195,200
  195 G(IJ) = G(IJ)-A(5,1)*G(IJ+2)

  200 G(IJ) = G(IJ)-A(J,I)*G(IJ+1)
      IF(J.EQ.N) GO TO 180
      J       = J+1
      IJ      = IJ+IDIM
      GO TO 192

  900 RETURN
      END
```

```
*DECK CUBE
      SUBROUTINE CUBE(X,Y,NN,B)
*CUBE--          FIT A SERIES OF CUBICS TO POINTS                    *CUBE*
*                END CONDITIONS ARE ARBITRARY
      DIMENSION X(10),Y(10),B(10)

C     ON ENTRY -
C      X,Y    = LISTS OF COORDINATES
C      N      = NO. OF POINTS (N.GE.2)

C       ALSO DEFINED ON ENTRY - IN COMMON/CCUBE/ -
C      NBC(L)= BOUNDARY CONDITION INDICATOR FOR LEFT(L=1) AND RIGHT(L=2)
C             = 0, 1, OR 2
C      YP(L) = FIRST DERIVATIVE  IF  NBC(L)=1
C      YPP(L)= SECOND DERIVATIVE IF  NBC(L)=2

C     ON RETURN-
C      B(I)  = FIRST  DERIVATIVE AT POINT  I  (I=1,N)

      COMMON /CCUBE / NBC(2),YP(2),YPP(2),FEND(2)
      COMMON /CCUBIC/ N,IA,IB
      COMMON /ERASE / A(3,266),DRASE(2)

      LOGICAL PARAB


C     INITIALIZE
      N       = NN
      IA      = 2
      IB      = N-1
      DX1     = X(2)-X(1)
      DY1     = Y(2)-Y(1)
      DXN     = X(N)-X(N-1)
      DYN     = Y(N)-Y(N-1)
C       NOTE *DXN* IS THE DELTA X FOR THE (N-1) INTERVAL.  DXNM1 WOULD BE
C       MORE PRECISE SYMBOL.

C     A STRAIGHT LINE IS USED FOR N=2 IF  NBC(1)=NBC(2)=0
      NBCS = NBC(1)+NBC(2)
      IF(N.GT.2 .OR. NBCS.GT.0) GO TO 80
      B(1)   = (Y(2)-Y(1))/(X(2)-X(1))
      B(2)   = B(1)
      GO TO 900

C     CHECK IF PARABOLA (F=0) SHOULD BE USED
   80 PARAB = (N.EQ.2 .AND. (NBC(1)*NBC(2)).EQ.0)   .OR.
     1         (N.EQ.3 .AND. NBCS.EQ.0)

C     NBC=01,  Y  AND  YP  SPECIFIED
C       LEFT END
  110 IF(NBC(1).NE.01) GO TO 120
      A(2,1)= 1.
      A(3,1)= 0.
      B(1)   = YP(1)
C       RIGHT END
  120 IF(NBC(2).NE.01) GO TO 210
      A(1,N)= 0.
      A(2,N)= 1.
      B(N)   = YP(2)

C     NBC=02,  Y  AND  YPP  SPECIFIED
C       LEFT END
```

```
  210 IF(NBC(1).NE.02) GO TO 220
      A(2,1)= 4.
      A(3,1)= 2.
      B(1)  = 6.*DY1/DX1 - YPP(1)*DX1
C       RIGHT END
  220 IF(NBC(2).NE.02) GO TO 310
      A(1,N)= 2.
      A(2,N)= 4.
      B(N)  = YPP(2)*DXN + 6.*DYN/DXN

C     NBC=0,   YPPP = F * YPPP(OF ADJACENT INTERVAL)
C       LEFT END
  310 IF(NBC(1).NE.0) GO TO 320
      A(2,1)= 1.
      A(3,1)= 1.
      B(1)  = 2.*DY1/DX1
      IF(PARAB) GO TO 320
      DX2   = X(3)-X(2)
      DY2   = Y(3)-Y(2)
      DX1DX2= DX1/DX2
      A(2,1)= A(2,1) + FEND(1)*DX1DX2
      A(3,1)= A(3,1) + FEND(1)*DX1DX2*(2.+DX1DX2)
      B(1)  = B(1) + FEND(1)*(3.*DY1+DY2*DX1DX2*DX1DX2)/DX2
C       RIGHT END
  320 IF(NBC(2).NE.0) GO TO 500
      A(1,N)= 1.
      A(2,N)= 1.
      B(N)  = 2.*DYN/DXN
      IF(PARAB) GO TO 500
      DXM   = X(N-1)-X(N-2)
      DYM   = Y(N-1)-Y(N-2)
      DXNDXM= DXN/DXM
      A(1,N)= A(1,N) + FEND(2)*DXNDXM*(2.+DXNDXM)
      A(2,N)= A(2,N) + FEND(2)*DXNDXM
      B(N)  = B(N) + FEND(2)*(3.*DYN+DYM*DXNDXM*DXNDXM)/DXM

  500 CALL CUBICS(X,Y,B)

  900 RETURN
      END
```

```
*DECK CUBERS
      SUBROUTINE CUBERS(X,NN)
*CUBERS           YPP  IN TERMS OF  Y                               *CUBERS*
C                 FOR CUBIC SPLINE EQUATIONS

C                 SPECIAL SMALL MATRIX VERSION WITH END CONDITIONS FOR *STC

       DIMENSION      X(10)

C     ON ENTRY -
C      X      = LIST OF DISTANCES
C      NN     = NO. OF POINTS (N.GE.3)

C       ALSO DEFINED ON ENTRY - IN COMMON/CCUBB/ -
C      NBC(L)= BOUNDARY CONDITION INDICATOR FOR LEFT(L=1) AND RIGHT(L=2)
C             = 0 IF FEND(L) IS SPECIFIED
C             = 1 FOR  YP(L)=0.
C             = 2 FOR  YPP(L)=0.
C             = 4 FOR  YP(L)=-C1(L)*Y(L)   AND  YPPP(L)=FEND(L)*YPPP(NEXT
C      FEND(L)= END/NEXT TO END VALUE OF YPPP IF NBC(L)=0

C     ON RETURN-
C      G(I,J)- MATRIX DEFINED BY  C=GY  WHERE C IS A VECTOR OF SECOND DER

      COMMON /CATM  / N,IDIM,B(5,5)
      COMMON /CCUBE / NBC(2),C1(2),C2(2),FEND(2)
      COMMON /ERASE / A(3,266),DRASE(2)

C****DEFINE COEFFICIENT MATRICIES *A* AND *B*, WHERE  A*YPP=B*Y

C     INITIALIZE
      N       = NN
      F1      = FEND(1)
      F2      = FEND(2)
      IF(N-3) 60,65,70
   60 CALL ERROR1
   65 F1      = 0.
      F2      = 0.
   70 CALL SETM(2,0., A,15,  B,25)
      DX1     = X(2)-X(1)
      DX2     = X(3)-X(2)
      DXM     = X(N-1)-X(N-2)
      DXN     = X(N)-X(N-1)
C       NOTE *DXN* IS THE DELTA X FOR THE (N-1) INTERVAL,  DXNM1 WOULD BE
C       MORE PRECISE SYMBOL.
      IA      = 2
      IB      = N-1

C     NBC=01,  YP=0.
C       LEFT END
  110 IF(NBC(1).NE.01) GO TO 120
      A(2,1)= DX1+DX1
      A(3,1)= DX1
      B(1,2)= 6./DX1
      B(1,1)= -B(1,2)
C       RIGHT END
  120 IF(NBC(2).NE.01) GO TO 210
      A(1,N)= DXN
      A(2,N)= DXN+DXN
      B(N,N-1)=6./DXN
      B(N,N)= -B(N,N-1)
```

```
C     NBC=02,  YPP=0,
C        LEFT END
  210 IF(NBC(1).NE.02) GO TO 220
      A(2,1)= 1.
C        RIGHT END
  220 IF(NBC(2).NE.02) GO TO 310
      A(2,N)= 1.

C     NBC=0,   YPPP = F * YPPP(OF ADJACENT INTERVAL)
C        LEFT END
  310 IF(NBC(1).NE.0)  GO TO 320
      A(1,1)= F1*DX1
      A(2,1)= DX2
      A(3,1)= -DX2-A(1,1)
C        RIGHT END
  320 IF(NBC(2).NE.0) GO TO 410
      A(3,N)= F2*DXN
      A(2,N)= DXM
      A(1,N)= -DXM-A(3,N)

C     NBC=04,  YP=C1*Y  AND  YPPP=F*YPPP(NEXT TO END)
C        LEFT END
  410 IF(NBC(1).NE.04) GO TO 420
      CALL ERROR1
C        RIGHT END
  420 IF(NBC(2).NE.04) GO TO 500
      A(2,N)= 1.
      IB     = N-2
      ADXN   = C1(2)*DXN
      C1PAD  = 1.+ADXN
      A(1,N-1)= DXM + F2*DXN*DXN/DXM*(3.+ADXN)/C1PAD
      A(2,N-1)= A(1,N-1)+DXM+3.*DXN*(2.+ADXN)/C1PAD
      B(N-1,N-2)=6./DXM
      B(N-1,N-1)=-6.*(1./DXM+C1(2)/C1PAD)

C     CUBIC RECURSION FORMULA BASED ON MATCHING  YP  AND  YPP
  500 IF(IB.LT.IA) GO TO 600
      DO 550 I=IA,IB
      A(1,I)=X(I)-X(I-1)
      A(3,I)=X(I+1)-X(I)
      A(2,I)=2.*(A(1,I)+A(3,I))
      B(I,I-1)=6./A(1,I)
      B(I,I+1)=6./A(3,I)
  550 B(I,I)=-B(I,I-1)-B(I,I+1)

C****DETERMINATION OF *G* BY MATRIX REDUCTION.  YPP=G*Y
  600 IDIM  = 5
      CALL ATDMRS

  900 RETURN
      END
```

```
*DECK CUBICS
      SUBROUTINE CUBICS(X,Y,B)
*CUBICS         SERIES OF CUBICS FIT TO COORDINATE POINTS    *CUBICS*
      DIMENSION X(100), Y(100), B(100)

C     INPUT=
C      X(I),Y(I)
C      A(1,I),A(2,I),A(3,I),B(I)    I=1,(IA-1)  AND  I=(IB+1),N   (I.E. B.C
C      IA,IB    RANGE IN WHICH THE COEFFICIENT MATRIX AND CONSTANT VECTOR
C               BE DEFINED BY EQUATIONS FOR MATCHING  YP  AND  YPP.
C      1,N      RANGE OF X,Y, AND B

C     OUTPUT
C      B(I)     SLOPE AT X(I)

      COMMON /CCUBIC/ N,IA,IB
      COMMON /ERASE / A(3,266), DRASE(2)

C     SET UP TRIDIAGONAL COEFFICIENT MATRIX  A  AND VECTOR  B.  ORDER OF
C      STORAGE IS ILLUSTRATED BY -
C         A(2,1)    A(3,1)                            B(1)
C         A(1,2)    A(2,2)    A(3,2)                  B(2)
C                   A(1,3)    A(2,3)    A(3,3)        B(3)
C                             A(1,4)    A(2,4)        B(4)

C      I      = POINTS AT WHICH YP AND YPP ARE MATCHED
C      IA,IB  = LIMITS OF I

      IF(IB.LT.IA) GO TO 100
      DO 70 I=IA,IB
      A(1,I)= X(I+1)-X(I)
      A(3,I)= X(I)-X(I-1)
      A(2,I)= 2.*(A(1,I)+A(3,I))
   70 B(I)   =3.*((Y(I+1)-Y(I))*A(3,I)/A(1,I)+(Y(I)-Y(I-1))*A(1,I)/A(3,I)
     1         )

C     ROUTINE  TDSEQ  - TRIDIAGONAL SIMULTANEOUS EQUATIONS
C      SOLUTION TO  AX=B.   ON RETURN SOLUTION VECTOR X IS STORED IN  B.
  100 A(3,1)= A(3,1)/A(2,1)
      B(1)   = B(1)/A(2,1)
      DO 150 I=2,N
      A(2,I)= A(2,I)-A(1,I)*A(3,I-1)
      A(3,I)= A(3,I)/A(2,I)
  150 B(I)   = (B(I)-A(1,I)*B(I-1)) / A(2,I)

      I      = N
  200 I      = I-1
      IF(I.LE.0) GO TO 900
      B(I)   = B(I)-A(3,I)*B(I+1)
      GO TO 200

  900 RETURN
      END
```

```
*DECK CUFIT
      SUBROUTINE CUFIT(X,Y,NPTS, NEW, XC,YC,NXC,ND, B)
*CUFIT.                                                                  *CUFIT*
C              INTEGRATE, INTERPOLATE FOR COORDINATES, 1ST, OR, 2ND DERIVAT
C              BY A CUBIC SPLINE CURVE FIT

       LOGICAL                     NEW
      DIMENSION X(10),Y(10), XC(10),YC(10), B(10)
C      NOTE, THE DIMENSION *10* DOES NOT NEED TO AGREE WITH THE CALLING

C     INPUT-
C      X, Y      PTS, ON CURVE
C      NPTS      NO. OF X
C      NEW       =1 (.TRUE.) TO FIT CURVE,  =0 (.FALSE.) TO USE LAST FIT
C      XC        LIST OF X AT WHICH CALC TO BE DONE
C      YC(1)     INTEGRATION CONSTANT IF  ND=-1
C      NXC       NO. OF XC
C      ND        =0 TO GET COORD,  =1 OR 2 TO GET 1ST OR SECOND DERIV,
C                =-1 FOR INTEGRATION
C     OUTPUT
C      YC        COORDINATE OR DERIVATIVE AT XC    OR
C                YC(IC)= INTEGRAL(Y*DX) FROM XC(1) TO XC(IC) WHERE IC=2,NXC
C      B(I)      FIRST DERIVAT AT POINT I (I=1,N)


C     NOTES-
C      *X* MAY BE IN EITHER ASCENDING OR DESCENDING ORDER,
C      FOR INTEGRATION *XC* MUST BE IN THE SAME ORDER AS *X*,  FOR INTERP
C         NO SPECIAL ORDER IS REQUIRED.

      LOGICAL WITHIN

C     FIT THE CUBIC SPLINE
      IF(.NOT.NEW) GO TO 100
      CALL CUBE(X,Y,NPTS, B)

C     INTERPOLATE
  100 I     = 1
      DO 150 IC=1,NXC

C     LOCATE APPROPRIATE INTERVAL
      WITHIN=.FALSE.
      NCOUNT=NPTS
      N     = NCOUNT-1
  101 NCOUNT=NCOUNT-1
      IF(NCOUNT.EQ.0) GO TO 120

      F     = (XC(IC)-X(I)) / (X(I+1)-X(I))
      IF(F.GE.0.) GO TO 110

C       F.LT.0.
      IF(I.EQ.1) GO TO 125
      IF(ND.EQ.(-1)) GO TO 120
      I     = I-1
      GO TO 101

  110 IF(F.LE.1.) GO TO 125

C       F.GT.1.0
      IF(I.EQ.N) GO TO 125
      IF(ND.EQ.(-1)) GO TO 126
  112 I     = I+1
```

```
      GO TO 101
  120 CALL ERROR1
C     PRELIMINARY CALCULATIONS FOR INTERPOLATION OR INTEGRATION
  125 WITHIN=.TRUE.
  126 DX    = X(I+1)-X(I)
      DY    = Y(I+1)-Y(I)
      D      = (B(I)+B(I+1)-2.*DY/DX)/(DX*DX)
      C      = (3.*DY/DX-(2.*B(I)+B(I+1)))/DX
      XD    = XC(IC)-X(I)
      L     = ND+2
      GO TO (130,140,141,142),L
C     ND=-1, INTEGRATE
  130 IF(.NOT.WITHIN) XD=DX
      S1        = (Y(I) + (B(I)/2. + (C/3. + D/4.*XD)*XD)*XD)*XD
      IF(WITHIN) GO TO 135
C     'I' IS BEING INCREMENTED TO FIND APPROPRIATE INTERVAL,  HENCE,
C      CUMULATE THE INTEGRAL OF THE ITH INTERVAL.
      SA    = SA + S1
      GO TO 112
C     APPROPRIATE INTERVAL FOUND,   X(I)-XC(IC)-X(I+1)
  135 IF(IC.EQ.1) SA=YC(IC)-S1
      IF(IC.NE.1) YC(IC)=SA+S1
      GO TO 150
C     ND=0,  INTERPOLATE FOR COORDINATES
  140 YC(IC)= Y(I) + (B(I) + (C + D*XD)*XD)*XD
      GO TO 150
C     ND=1,  FIRST DERIVATIVE
  141 YC(IC)= B(I) + (2.*C + 3.*D*XD)*XD
      GO TO 150
C     ND=2,  SECOND DERIVATIVE
  142 YC(IC)= 2.*C + 6.*D*XD
  150 CONTINUE
      RETURN
      END
```

```
*DECK CUFITR
      SUBROUTINE CUFITR(X,NIC,IMID)
*CUFITR          TEMPORARY ROUTINE FOR                          *CUFITR*
C                DETERMINING INFLUENCE COEFFICIENTS
C                FOR INFIELD BOUNDARY POINTS
C                WHICH TERMINATE *PARTIAL ORTHOGONALS*

       DIMENSION X(4)

      COMMON /CATM  / NX,XDIM,G(5,5)
      DIMENSION        Y(4),B(4)

      X3     = X(IMID)

C     SHIFT X-ELEMENTS ABOVE *IMID* TO THE LEFT
      NMOVE = NIC-IMID
      CALL MOVE(1,X(IMID+1),X(IMID),NMOVE,1)

      NI = NIC - 1
      DO 60 I=1,NI
      DO 50 II=1,NI
   50 Y(II) = 0.
      Y(I)  = 1.
   60 CALL CUFIT(X,Y,NIC-1, .TRUE., X3,G(IMID,I),1,0,B)

C     SHIFT G(IMID,I) TO THE RIGHT FOR I.GT.IMID
      I      = NI
   70 G(IMID,I+1) = G(IMID,I)
      I      = I-1
      IF(I.GE.IMID) GO TO 70
      G(IMID,IMID)=-1.
      RETURN
      END
```

```
*DECK FFINC
      SUBROUTINE FFINC
CFFINC         INFLUENCE COEFFICIENTS ON FAR FIELD BOUNDARY       -FFINC-
      COMMON /CFB    / L,MA,MB,DFB(30)
      COMMON /CFFINC/ GFF(6)
      COMMON /CFRFIN/ DM(4),ZDN1,ZDN25
      COMMON /CIDEX / M,J,MU,MD,ISTAG
      COMMON /CS1    / S1(300)
      COMMON /CZ     / Z(300)
C
    1 M      = MB
      CALL GETIX
      QDS1   = 2./(S1(MD)-S1(MU))
C     COMPUTE INFLUENCE COEFFICIENTS
      GFF(2)= 0.
      GFF(6)= 0.
      IF( MU.EQ.0 .OR. MD.EQ.0 ) GO TO 20
      GFF(3)= -.865*QDS1
      GFF(4)= -2.*GFF(3)
      GFF(5)= GFF(3)

      GO TO 2
   20 GFF(3)= 0.
      GFF(5)=0.
      IF( MD.EQ.0 ) GO TO 25
      DS1    = S1(MD)-S1(M)
      GFF(5)= -.865/DS1
      ZL     = Z(M)-ZDN1
      RATIO = ((ZL-DS1)/ZL)**2
      GFF(4)= GFF(5)*(RATIO-2.)
      GO TO 2
   25 DS1    = S1(M)-S1(MU)
      GFF(3)= -.865/DS1
      ZL     = ZDN25-Z(M)
      RATIO = ((ZL-DS1)/ZL)**2
      GFF(4)= GFF(3)*(RATIO-2.)
    2 RETURN
      END
```

```
*DECK DUP3
      SUBROUTINE LFIT2D(X,Y,TO,NXY)
*LFIT2D          LINEAR SURFACE INTERPOLATION                        *LFIT2D*
C                IN A RECTANGULAR GRID
      DIMENSION       X(2),Y(2),TO(2)

C     INPUT-
C      X,Y    = LIST OF COORDINATES AT WHICH INTERPOLATED VALUES ARE TO BE
C      NXY    = NO OF COORDINATE POINTS

C      NXT    = NUMBER OF XT
C      NYT    = NUMBER OF YT
C      XT     = X-GRID OF T-TABLE
C      YT     = Y-GRID OF T-TABLE
C      T      = TABLE OF VALUES
C      NOTE   - NUMBER OF T-VALUES IS NXT*NYT, ORDER IS ILLUSTRATED BELOW
C         YT(NYT)*  T(3)        T(6)        T(NXT*NYT)
C         YT(2)  *  T(2)        T(5)        T(8)
C         YT(1)  *  T(1)        T(4)        T(7)
C                *-*-----*---*--*--*---*-------------------
C                   XT(1)       XT(2)       XT(NXT)

C     OUTPUT-
C      TO     = INTERPOLATED VALUES AT X,Y

      COMMON /CTHICK/ NXT,NYT,XT(20),YT(20),T(78)
      COMMON /ERASE / DUM(400),T1(200),T2(200)

C     FIND CORRECT X-INTERVAL
      I       = 1
      M       = 1
      ISV     = 0
  100 NCOUNT= 0
  105 IF(X(M).LT.XT(I)) GO TO 110
      IF(X(M).GT.XT(I+1)) GO TO 120
      F       = (X(M)-XT(I))/(XT(I+1)-XT(I))
      GO TO 150
  110 IF(I.EQ.1) GO TO 140
      I       = I-1
      GO TO 125
  120 IF((I+1).GE.NXT) GO TO 145
      I       = I+1
  125 NCOUNT= NCOUNT+1
      IF(NCOUNT.GT.NXT) CALL ERROR1
      GO TO 105
  140 F       = 0.
      GO TO 150
  145 F       = 1.

C     INTERPOLATE WRT Y
  150 IF(I.EQ.ISV) GO TO 160
      IJ2     = I*NYT+1
      IJ1     = IJ2-NYT
      CALL LFIT1(YT,T(IJ1),NYT, Y,T1,NXY)
      CALL LFIT1(YT,T(IJ2),NYT, Y,T2,NXY)
      ISV     = I

C     INTERPOLATE WRT X
  160 TO(M) = F*T2(M)+(1.-F)*T1(M)

      M       = M+1
      IF(M.LE.NXY) GO TO 100
```

```
C...  END LOOP FOR INTERPOLATIONG TO(M) AT X(M),Y(M),M=1,NXY
      RETURN
      END
```

```
*DECK SS5PTI
      SUBROUTINE SS5PTI(XX,G)
*SS5PTI          SUPERSONIC 5-PT INFLUENCE COEFFICIENTS       *SS5PTI*
      DIMENSION          XX(5),G(25)

C     INPUT-
C      XX     = STREAMWISE DISTANCE OF FOUR POINTS, XX(1),..,X(4)

C     OUTPUT-
C      G      = CHANGE IN SECOND DERIVATIVE, D2YDX2, PER UNIT CHANGE IN
C                 YY(0),...,Y(4)

      COMMON /CSS5PT/ X(4),Y(4), X21,X31,X32,X41,X42,X43, A0,A1,A2,A3,A4

C     X(0)  = 0.
      DO 65 I=1,4
   65 X(I)  = XX(I+1)-XX(1)
      CALL SS5PT
      G(5)  = A0
      G(10) = A1
      G(15) = A2
      G(20) = A3
      G(25) = A4
      RETURN
      END
```

```
*DECK IAD
      SUBROUTINE IAD
*IAD          IMPLICIT ALTERNATING DIRECTION ROUTINE--STC                  -IAD-
C     INPUT
C      MLB,MUB,LO,LNEXT---STATION TABLE
C      B(M) = INDICATOR  (B.GT.0--SUBSONIC)  (B.LE.0 -- SUPERSONIC)
C      A1,A2,A3,A4,A5,A6,A7,A8 = INFLUENCE COEFFICIENTS
C      RHS(M) = RIGHT HAND SIDES OF MATRIX EQUATION
C      A4(M) = 1. FOR FIRST POINT OF DOUBLE STREAMLINE
C     IADM  = -1   LINE RELAXATION ALONG STREAMLINE
C     IADM  =  0   ALTERNATING ORTHOGONAL, STREAMLINE RELAXATION
C     IADM  =  1   LINE RELAXATION ALONG ORTHOGONAL

C     STATION TABLE
C      INDEX= L=LO,LESTA
C      SCHOKE= STATION CHOKE INDICATOR (ADJWF,BRMS,WRIOUT)
C      MCL    = SHARP CORNER INDICATOR (BLDTBS)
C      MCL    = FIELD INDEX OF CONTROL STREAMLINE (PTMOVE,FLOBAL)
       COMMON /CHDATA/ X1(1),LNEXT(1),MLB(1),MUB(1),PRIM(1),
     1                 TYPELB(1),NAMELB(1),ILB(1),FLB(1),S1LB(1),
     1                 TYPEUB(1),NAMEUB(1),IUB(1),FUB(1),S1UB(1),
     &                 VMB(1),DWDV(1),X2CL(1),SLSWI(1),MCL(1),
     &                 ANGTE(1),PTTE(1),PSTE(1),FGRTE(1),RGTE(1),
     &                 ANGEXP(1),BSQEXP(475)
         DIMENSION     CRVLE(1),ANGLE(1)
         EQUIVALENCE   (SCHOKE,DWDV),(CRVLE,ANGTE),(ANGLE,PTTE)
         INTEGER       PRIM,TYPELB,TYPEUB,SCHOKE(1)
C

       COMMON /CA2    / A2(768)
       COMMON /CA3    / A3(768)
       COMMON /CA4    / A4(768)
       COMMON /CA5    / A5(768)
       COMMON /CA6    / A6(768)
       COMMON /CA7    / A7(768)
       COMMON /CA8    / A8(768)
        DIMENSION      A0(300),A1(300)
        EQUIVALENCE    (A0,A6),(A1,A5)
       COMMON /CB     / B(768)
       COMMON /CDDS2  / DDS2
       COMMON /CDS2   / DS2(768)
       COMMON /CIDEX  / MM2,JS,M1,MDN,ISTAG
       COMMON /CIDEXR/ M,MJ1(4),M3,MJ2(4),M5,MJ4(4),M2,MJ5(4),M6,MJ6(4)
       COMMON /CLBL   / LBL,LSS(2),LBLDUM(5)
       LOGICAL         LBL
       COMMON /CM     / JMS(768)
       COMMON / CMAX4 / ES2MAX, ZMX, RMX, DS2MAX, LDUMY
       COMMON /CMAXIT/ MAXIT,NREFIN,DUMIT(2)
       COMMON /CPI    / PI,DUMPI(5)
       COMMON /CPRINT/ PDUM(6),PRT(20)
       COMMON /CRHS   / RHS(768)
       COMMON /CSS    / SSFML,SSEF,SSEANG,SSDF,SSFEND,SSFND1
     1                ,SSDLE,A4FACT,BRLX,CURRLX,TSIC
        INTEGER        SSFML
        LOGICAL               SSEF,        SSDF,     SSDLE
       COMMON /CTOLRL/ TOLRL,MAXSWP,CLEN,DS2MX,TOLES2,NSWP,DTOLRL(6),
     *                 SG1MIN,TOLINR
       COMMON /ERASE2/ AA4(128),AA8(128),BB(128),A41(128),A42(128),
     *                 MSAVE(128),DRASE(732)
       COMMON /IXORIG/ LHO,LHE, LBDO,LBDE, LTO,LTE, LWO,LWE, LFO,LFE,
     *                 LO,LESTA,  LDUM(8),
     *                 MO,NM, NJ,NFCOLS, MAXNJ,MAXOL,MAXNM,MAXLE,
```

```
     *                  LEO,LEE, LRO,LRE,LRD
      DIMENSION         LIMITS(24)
      EQUIVALENCE       (LIMITS,LHO)

C     INITIALIZE DS2 TO 0.;  NSWP=0
      CALL SETM(1.0.,DS2,NM)
      NSWP   = 0
      ASSIGN 235 TO LGO
      ALIM   = SQRT( FLOAT(NM) )
      LIMSWP= MAXSWP-IFIX(ALIM)-2
      FNM    = 1./ALIM
      CLENX  = 4.*SG1MIN
      ITYPE  = IADM+2
      XXK    = 0.
      RHO    = RHOBAS

C     LOOP TO SWEEP THROUGH STATIONS
      LSTART= LO
      LEND   = LESTA
      IF( .NOT.LBL ) GO TO 1
      IF( LSS(2).EQ.0 .OR. LSS(2).LT.LSS(1) ) RETURN
C     SET LIMITS FOR LINE BY LINE SUPERSONIC SOLUTION
      ITYPE  = 2
      LSTART= LSS(1)
      LEND   = LSS(2)+1
    1 L      = LSTART
      DS2MX  = 0.
      DDS2   = 0.
      IF( RHOAMP.EQ.0. ) GO TO 1111

C     COMPUTE RHO --ITERATION FACTOR
      XXK    = XXK+1.
      IF( XXK.GE.ALIM ) XXK=1.
      TSIN   = SIN(.5*XXK*PI*FNM)
      RHO    = RHOBAS+2.*RHOAMP*TSIN**2
 1111 RHO1   = 1.-RHO
      GO TO (200,2,2) , ITYPE
C     LOOP ACROSS STREAMLINES
    2 MA     = MLB(L)
      MB     = MUB(L)
      IF(NSWP.GE.LIMSWR) PDUM(3)=1.
      M      = MA
    3 K      = 0
    4 K      = K+1

C     BUILD COEFFICIENT TABLES FOR TDSEQ ON ORTHOGONAL
C     GET M2,M3,M5,M6 INDICES
      CALL GETRLX
C     CALCULATE MODIFIED RIGHT HAND SIDES
      IF( B(M).LE.0. ) GO TO 20

C     SUBSONIC BRANCH
   10 AA41   = -(A2(M)+A3(M)+A5(M)+A6(M))
      AA42   = A4(M)-AA41
      BB(K)  = RHS(M)-(A2(M)*DS2(M2)+A3(M)*DS2(M3)+RHO1*AA41*DS2(M)
     *                +A5(M)*DS2(M5)+A6(M)*DS2(M6))
      AA4K   = AA42+RHO*AA41
      GO TO 30

C     SUPERSONIC BRANCH        -------GET INDEX-- M1
```

```
C     SPECIAL 5 POINT CUBIC-- SSFML=3, PICK UP A0
   20 M1      = M2
   21 MM2     = M1
      CALL GETIX
      IF( M1.EQ.0 ) M1=M
      IF( ISTAG.EQ.3 ) GO TO 21
      M1SAV = M1
   25 MM2     = M1
      CALL GETIX
      IF( M1.EQ.0 ) M1=M
      IF( ISTAG.EQ.3 ) GO TO 25
      M0      = M1
      M1      = M1SAV
      AA41    = -(A2(M)+A3(M)+A1(M)+A0(M))
      AA42    = A4(M)-AA41
      BB(K)   = RHS(M)-(A1(M)*DS2(M1)+A2(M)*DS2(M2)+A3(M)*DS2(M3)+RHO1*
     *                 AA41*DS2(M) +A0(M)*DS2(M0))
      AA4K    = AA42+RHO*AA41
      IF(SSFML.EQ.3) GO TO 29

C     TRIDIAGONAL DECOMPOSITION
C     IF A6(M)=0, ADJUST LOCALLY TO RHO=1
   30 IF( A6(M).NE.0. ) GO TO 31
   29 BB(K)   = BB(K)+RHO1*AA41*DS2(M)
      AA4K    = AA4K+RHO1*AA41
   31 IF( K.GE.2 ) GO TO 50
      AA8(K)= A8(M)/AA4K
      BB(K)   = BB(K)/AA4K
      GO TO 61

C     FORWARD DECOMPOSITION
C     SPECIAL LOGIC FOR 2-ND OF DOUBLE POINTS
   50 IF(A4(M).NE.1.) GO TO 51
      GO TO 60
   51 IF(A4(M-1).NE.1.) GO TO 60
      IF( B(M).LE.0. ) GO TO 52
      AA41    = -(A2(M)+A3(M)+A5(M)+A6(M))
      GO TO 53
   52 AA41    = -(A2(M)+A3(M)+A1(M))
   53 AA42    = A4(M)-AA41
      AA4K    = AA42+RHO*AA41
      IF( A6(M).EQ.0. .OR. (B(M).LE.0. .AND. SSFML.EQ.3 ) )
     *AA4K    = AA4K+RHO1*AA41
      AA4K    = 1./(AA4K+A7(M)*AA8(K-1)*AA8(K-2))
      AA8(K)= A8(M)*AA4K
      BB(K)   = (BB(K)-A7(M)*(BB(K-2)-AA8(K-2)*BB(K-1)))*AA4K
      GO TO 61
   60 AA4K    = 1./(AA4K-A7(M)*AA8(K-1))
      AA8(K)= A8(M)*AA4K
      BB(K)   = (BB(K)-A7(M)*BB(K-1))*AA4K
   61 IF( M.GE.MB ) GO TO 62
      M       = M+1
      GO TO 4
   62 DS2(M)= BB(K)

C     BACK SUBSTITUTION
   70 M       = M-1
      K       = K-1
      IF( M.LT.MA ) GO TO 100
      BB(K)   = BB(K)-AA8(K)*BB(K+1)
```

```
C     CALCULATE DDS2,DS2MX
      IF ( ABS(BB(K) - DS2(M) ) .LT. DDS2 ) GO TO 75
      MDDS2 = M
      DDS2  = ABS(BB(K) - DS2(M) )
   75 DS2(M)= BB(K)
      DS2MX = AMAX1( DS2MX,ABS(DS2(M)) )
      GO TO 70

C     INDEX TO NEXT STATION
  100 IF( DS2MX.GT.CLENX ) CALL ERROR1
      L     = L+LNEXT(L)
      IF( L.LT.LEND ) GO TO 2
C     INCREMENT SWEEP COUNTER
      NSWP  = NSWP+1
      IF( PDUM(3).NE.0. ) CALL TABPRT(5HDS2=A,DS2,NM,NJ)
      IF( PDUM(3).NE.0. ) WRITE (6,999) DDS2,MDDS2,DS2MX,RHO
  999 FORMAT(//6X,5HDDS2=,1PE16.8,6X,7HMDDS2= ,I4,6X,6HDS2MX=,E16.8,
     1 6X,4HRHO=,0PF12.8//)
      IF( IADM.EQ.1 .OR. LBL ) GO TO 321

C     LOOP TO SWEEP CROSS-STREAM ALONG STREAMLINES
C     NOTE*** ISTAG=3 POINTS ARE SKIPPED
  200 J2    =NJ
      DS2MX = 0.
  202 M     = MBEGIN(J2)
C     CONSTRUCT MATRIX COEFFICIENTS ALONG STREAMLINE
      K     = 0
  203 K     = K+1
C     GET INDICES M2,M3,M5,M6
  205 MSAVE(K)= M
      CALL GETRLX
C     IF B(M).LE.0.--(SUPERSONIC-- SUBTRACT A1*DS2(M1) FROM BB
C     IF SSFML.EQ.3 ALSO SUBTRACT A0*DS2(M0) FROM BB
      A41K  = -(A2(M)+A3(M)+A5(M)+A6(M))
      IF( B(M).LE.0. ) A41K=A41K+A5(M)+A6(M)
      A42K  = A4(M)-A41K
      AA4K  = A41K+RHO*A42K
      MDB   = M-1
      IF( A4(M-1).EQ.1.) MDB=M-2
      BB(K) = RHS(M)-(A7(M)*DS2(MDB)+RHO1*A42K*DS2(M)
     *                  +A8(M)*DS2(M+1))
      IF( B(M).GT.0. ) GO TO 206
      M1    = M2
 2051 MM2   = M1
      CALL GETIX
      IF( M1.EQ.0 ) M1=M
      IF( ISTAG.EQ.3 ) GO TO 2051
      M1SAV = M1
 2052 MM2   = M1
      CALL GETIX
      IF( M1.EQ.0 ) M1=M
      IF( ISTAG.EQ.3 ) GO TO 2052
      M0    = M1
      M1    = M1SAV
      BB(K) = BB(K)-A1(M)*DS2(M1)-A0(M)*DS2(M0)


C     PENTA-DIAGONAL MATRIX-- DECOMPOSITION
C     ADJUST TO RHO=1 IF A7(M)=0.
  206 IF( A7(M).NE.0. ) GO TO 207
      BB(K) = BB(K)+RHO1*A42K*DS2(M)
```

```
      AA4K   = AA4K+RHO1*A42K
  207 IF( K.GT.2 ) GO TO 220
      GO TO (208,210) , K
  208 CM     = 1./AA4K
      A41(K)= A5(M)*CM
      IF( B(M).LE.0. ) A41(K)=0.
      A42(K)= A6(M)*CM
      IF( B(M).LE.0. .AND. SSFML.EQ.3 ) A42(K)=0.
      BB(K) = BB(K)*CM
      GO TO 225
  210 CM     = 1./(AA4K-A3(M)*A41(K-1))
      A41(K)= (A5(M)-A3(M)*A42(K-1))*CM
      IF( B(M).LE.0. ) A41(K)=A41(K)-A5(M)*CM
      A42(K)= A6(M)*CM
      IF( B(M).LE.0. .AND. SSFML.EQ.3 ) A42(K) = A42(K)-A6(M)*CM
      BB(K) = (BB(K)-A3(M)*BB(K-1))*CM
      GO TO 225
  220 CMA    = A3(M)-A2(M)*A41(K-2)
      CM     = 1./(AA4K-A2(M)*A42(K-2)-CMA*A41(K-1))
      A41(K)= (A5(M)-CMA*A42(K-1))*CM
      IF( B(M).LE.0. ) A41(K)=A41(K)-A5(M)*CM
      A42(K)= A6(M)*CM
      IF( B(M).LE.0. .AND. SSFML.EQ.3 ) A42(K) = A42(K)-A6(M)*CM
      BB(K) = (BB(K)-A2(M)*BB(K-2)-CMA*BB(K-1))*CM
  225 IF( M5.EQ.M ) GO TO 230
      M      = M5
      GO TO 203

C     BACK-SUBSTITUTION LOOP
  230 ASSIGN 231 TO JGO
      GO TO 250
  231 K      = K-1
      ASSIGN 240 TO JGO
      BB(K) = BB(K)-A41(K)*BB(K+1)
      M      = MSAVE(K)
      GO TO 250
  240 K      = K-1
      M      = MSAVE(K)
      IF( K.LT.1 ) GO TO 300
      BB(K) = BB(K)-A41(K)*BB(K+1)-A42(K)*BB(K+2)

C     CALCULATE DDS2,DS2MX
  250 IF ( ABS(BB(K) - DS2(M) ) .LT. DDS2 ) GO TO 255
      MDDS2 = M
      DDS2  = ABS(BB(K) - DS2(M) )
  255 DS2(M)= BB(K)
      DS2MX = AMAX1(DS2MX,ABS(DS2(M)) )
      GO TO JGO , (231,240)
  300 IF( DS2MX.GT.CLENX ) CALL ERROR1
      J2     = J2-1
      IF(J2.GT.0) GO TO 202
      IF( PDUM(3).NE.0. ) CALL TABPRT(5HDS2-B,DS2,NM,NJ)
      IF( PDUM(3).NE.0. ) WRITE (6,999) DDS2,MDDS2,DS2MX,RHO

C     INCREMENT SWEEP COUNTER
  320 NSWP   = NSWP+1
C     STREAMLINE SWEEP COMPLETE-- CHECK CONVERGENCE
  321 IF( DDS2.LE.TOLRL*DS2MX ) GO TO 900
      IF( NSWP.LE.MAXSWP ) GO TO 1
      ASSIGN 234 TO LGO
  902 GO TO LGO , (234,235)
```

```
234 CALL ERROR1
235 IF(PDUM(3).EQ.0.) GO TO 260
    WRITE (6,1000)
    DO 400 I=1,NM
    WRITE (6,1001) I,B(I),A2(I),A3(I),A4(I),A5(I),A6(I),A7(I),A8(I),
   1              DS2(I),RHS(I)
400 CONTINUE
1000 FORMAT (4H1  M,11X,1HB,10X,2HA2,10X,2HA3,10X,2HA4,10X,2HA5,10X,
   1        2HA6,10X,2HA7,10X,2HA8,9X,3HDS2,9X,3HRHS)
1001 FORMAT (1H ,I3,8F12.3,2F12.6)
C    GET ACTUAL MAX DS2  ( WITH SIGN )
260 CALL MINMAX ( DS2, 1, NM, DS2MIN, IMIN, DS2MAX, IMAX )
    IF ( ABS(DS2MIN) .GT. ABS(DS2MAX) ) DS2MAX = DS2MIN
    RETURN
    END
```