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A COMPUTER PROGRAM FOR ESTIMATING THE AERODYNAMIC CHARACTERISTICS OF NACA 16-SERIES AIRFOILS

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SUMMARY

A computer program has been written which provides a comprehensive data base on NACA 16-series airfoils. The geometry covered in the program is limited to cambers for a design-lift coefficient from 0.0 to 0.7 and thickness ratios from 4 to 21 percent. The data include Mach numbers from 0.3 to 1.6, angles of attack from -4 to 8 degrees, and lift coefficients from 0.0 to 0.8. Extrapolation is used to obtain data from Mach numbers, angles of attack, and lift coefficients beyond those for which data were available. A subroutine to adjust the lift and drag coefficients beyond stall is included. The complete listing of the program is provided in the Appendix.

INTRODUCTION

After decades of neglect, propeller research in the United States has been reactivated due to the energy shortage. Most of the general aviation aircraft use propeller designs based on the technology that has not changed significantly since the 1940's and early 1950's. Propeller compressibility losses have caused current propeller-powered general aviation aircraft to be limited to maximum cruise speeds near Mach 0.5. The desire for improvements in swirl recovery and noise control required improved technology. Recent technological developments performed as part of NASA's Advanced Turboprop Project offer the potential of extending the limit to at least Mach 0.8. For advanced high-speed turboprop powered aircraft, compared to equivalent technology high-bypass-ratio turbofans, studies have shown that a large performance advantage may be obtained at cruise speeds up to Mach 0.8. These advantages could result in lower acquisition and reduced life cycle cost, large fuel savings, improved range, swirl recovery, and noise control, or other benefits for both future civil and military aircraft.

Airfoil research has become a major factor in the propeller performance research. The NACA 16-series airfoil sections are low-drag, high-critical-speed airfoils that could be effective in the advanced turboprop designs currently under study. These airfoil sections, which have proven useful for propellers, have relatively sharp leading and trailing edges, and have maximum thickness at mid-chord station. They are designed to work efficiently at high speed by delaying compressibility stall.

A comprehensive and easily accessible data bank on the aerodynamic characteristics of 16-series sections was needed to facilitate the studies performed. A literature survey revealed that data over a large range of cambers, thicknesses, angles of attack, and Mach numbers were not available, so a computer program was written to provide the needed data base. The requirements for the program included complete flexibility of input conditions, section Mach numbers to at least 1.1, easy accessibility, low-cost operation, and the ability to interpolate for nonstandard geometry. To fulfill these requirements, the program was written in a table "look-up" format, so that its only limitations would be the range of its data and the accuracy of the linear interpolation. The most comprehensive source for the aerodynamic characteristics of 16-series airfoils was reference 1, and these values make up the program's data declarations.

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The present paper discusses the use and limitations of the program. The program will shortly be made available to outside uses through COSMIC. Langley Research Center uses will find it as the common permanent file system under user number 624435N, with the file name NACA16.

DISCUSSION

A preliminary program was written using values for only the 16-5XX airfoils with thickness ratios from 4 to 18 percent, nine Mach numbers from 0.3 to 1.3, and seven angles of attack from -4.0 to 8 degrees. A linear shift was used to account for other cambers. Extensive computation showed that the program's results were not as accurate as desired. By expanding the data tables in the program, better accuracy could be attained. More points on each curve were entered and more sections were represented. The capability to calculate the drag coefficient was added.

Digitizing equipment was used to enter the values from the graphic form of reference 1 into the data tables. This method was accurate and efficient, enabling many points to be entered in a short time directly from the curve, and allowing complete freedom in representing the curve (i.e., the values f(x) could be entered for any x). A total of 100 graphs were digitized. The values were then used to generate tables corresponding to a standard set of Mach numbers; 26 values of Mach number from .3 to 1.6 are used. These are used as the data declaration in the subroutine and have the following format:

CLXXX (row, column) = a function of angle of attack (row), and Mach number (column)

CDXXX (row, column) = a function of lift coefficient (row), and Mach number (column)

ALPXXX (row, column) = a function of lift coefficient (row), and Mach number (column)

where the first X in XXX notation represents the design lift coefficient in tenths (i.e., 7 = 0.7 design-lift coefficient) and the remaining two XX in this notion represents the airfoil thickness-to-chord ratio (thus, 706 signifies a 0.7 design-lift coefficient and a 0.06 thickness-to-chord ratio). The values for the lift coefficient were tabulated for selected angles of attack and Mach number and the values for drag coefficient and angle of attack (ALP) were tabulated for selected values of lift coefficient and Mach number in the above-mentioned data declarations.

The improvement achieved by augmenting the data is illustrated in figures 1 through 6. Figure 1 shows the points that made up one of the tables in the first version of the program. Figure 2 shows the points that were digitized, and figure 3 presents the points that make up the data table in the upgraded version. In figure 4, the improved representation is demonstrated; it compares the curves represented by the data tables in each version of the program. Clearly, the addition of more data points improved the accuracy of the interpolation. A graph of the points in a representative drag coefficient table is presented in figure 5, and a similar representation of an angle-of-attack curve is shown in figure 6.

The main program controls the input and output. Figure 7 provides a brief flowchart of the program. All of the table look-ups and interpolations are done in the subroutines. The subroutine IBI performs the table look-up and returns the value for

the desired aerodynamic characteristic. A linear interpolation between thickness ratios occurs in the subroutines AER00, AER01, AER02....AER0X (where X represents the camber of the airfoil). Subroutine CAMBER interpolates between design-lift coefficients. Warning messages are printed if the data limits have been exceeded.

An additional subroutine (COMPUT) was written to account for the nonlinear behavior of lift coefficient beyond the stall angle. The method uses the graphs of reference 1, and the procedure is a "table look-up" using first-order interpolation. Essentially, the lift coefficient becomes a function of Reynolds number as well as of Mach number, angle of attack, and geometry. The drag coefficient is also adjusted in this subroutine.

LIMITATIONS AND ERROR

The primary limitation in the use of the program arises from the spareness of data. The geometry for which the program can be used is limited to cambers for design lift coefficients up to 0.7 and thickness ratios between 4 and 21 percent. Data were unavailable for Mach numbers below .3 and above 1.6; angles of attack below -4 degrees and above 8 degrees, and lift coefficients (for drag calculations) below 0.0 and above 0.8; however, the program is capable of extrapolating for conditions beyond these limits and of modifying the coefficients at angles of attack beyond stall. No wind-tunnel data at these conditions were available for comparison, so it is difficult to estimate the accuracy of the program's output.

Some studies were done to evaluate the program in the range for which data were available. First, the program was compared with the graphs of reference 1 from which the program's data were derived. The average error was less than 5 percent for both low and transonic Mach numbers demonstrating that the errors due to linear interpolation and digitizing are minimal. Next, two sources of wind-tunnel data (refs. 2 and 3) were found and compared to each other. Some discrepancies were found. The error ranged from 0 to 68 percent, with the average at approximately 12 percent. The program produced results close to the data from reference 2, particularly at low speed. The lift coefficient was more accurate than the drag coefficient. The error was significantly higher in the comparison between the program and reference 3. The only trend observed in this study was that the drag coefficient was markedly more accurate at low speed while the lift coefficient was more accurate at transonic speed.

CONCLUDING REMARKS

A computer program has been written which provides a comprehensive data base on NACA 16-series airfoils. The geometry covered in the program is limited to cambers for a design-lift coefficient from 0.0 to 0.7 and thickness ratios from 4 to 21 percent. The data include Mach numbers from 0.3 to 1.6, angles of attack from -4 to 8 degrees, and lift coefficients from 0.0 to 0.8. Extrapolation is used to obtain data from Mach numbers, angles of attack, and lift coefficients beyond those for which data were available. A subroutine to adjust the lift and drag coefficients beyond stall is included. The program can be used for airfoils with camber for a design lift coeffient up to 0.7, with thickness ratios from 4 to 21 percent, and for Mach numbers from 0.3 to 1.6. In comparison with wind-tunnel data, it has been shown to give reasonable results.

```
      PROGRAM AIRFOIL(INPUT,OUTPUT,TAPE3=INPUT,TAPE6=OUTPUT)
C
C   THE SUBROUTINES IN THIS PROGRAM CALCULATE THE AERODYNAMIC
C   CHARACTERISTICS OF NASA 16-SERIES AIRFOILS.  ALL VALUES ARE
C   OBTAINED THROUGH INTERPOLATIONS FROM GRAPHS DRAWN BY HENRY V.
C   BORST (SEE SOURCE).  SUBROUTINE IBI INTERPOLATES BETWEEN MACH
C   NUMBERS AND ALPHAS/CL'S; SUBROUTINE AEROX INTERPOLATES BETWEEN
C   THICKNESS RATIOS; SUBROUTINE CAMBER INTERPOLATES BETWEEN
C   CAMBERS.  SUBROUTINE COMPUT IS USED TO ADJUST THE CD IF THE
C   ANGLE OF ATTACK IS BEYOND STALL.
C
C   ALL LIMITATIONS IN THIS PROGRAM ARE DUE TO THE LACK OF DATA.
C   THE LIMITING CASES ARE:
C   DESIGN CL:  0.0 TO 0.7
C   THICKNESS RATIO:  (FOR 0.0 <= CLDES <= 0.5) 4% TO 21%
C                     (FOR 0.5 < CLDES < 0.6) 4% TO 15%
C                     (FOR 0.6 < CLDES <= 0.7) 6% TO 12%
C   MACH NUMBER:  .3 TO 1.6 (BUT EXTRAPOLATION CAN BE PERFORMED)
C   ANGLE OF ATTACK(PERFORMANCE):  -4.0 TO 8 (BUT EXTRAPOLATION CAN
C   BE PERFORMED)
C   CL(DESIGN):  0.0 TO 0.8 (BUT EXTRAPOLATION CAN BE PERFORMED)
C   WARNING MESSAGES WILL BE PRINTED IF THESE VALUES ARE EXCEEDED.
C   THE PROGRAM HAS BOTH PERFORMANCE ANALYSIS AND DESIGN CAPABILITIES.
C   FOR THE FORMER LET IKEY=1, AND FOR THE LATTER LET IKEY=2.
C
C   IF IKEY=1 INPUT MUST BE:
C   MACH NUMBER, ANGLE OF ATTACK, THICKNESS RATIO, DESIGN CL, ALTITUDE, COR,& D
C   IF IKEY=2 INPUT MUST BE:
C   MACH NUMBER, CL, THICKNESS RATIO, DESIGN CL, ALTITUDE, COR,& D
C
C   SOURCE
C
C   SAND, EDWARD, DOUGLAS A. ELLIOT, JR., AND HENRY BORST, "USAAMRDL
C        TECHNICAL REPORT 73-34C SUMMARY OF PROPELLER DESIGN
C        PROCEDURES AND DATA" VOLUME III HUB ACTUATOR, AND CONTROL
C        DESIGN, FORT EUSTIS, VA., NOV. 1973
C
C
      DIMENSION XM(7),AA(5),CLDES(5),TR(2)
      DATA(XM(I),I=1,7)/.2,.5,.7,.8,.9,1.0,1.1/
      DATA(CLDES(I),I=1,5)/.3,.35,.4,.45,.5/
      DATA(AA(I),I=1,5)/4,8,10,12,16/
      DATA(TR(I),I=1,2)/.06,.12/
      DATA NUMACH,NUMCLD,NUMTR,NUMAA/7,5,2,5/
      COR=.1
      IKEY=1
      D=10.
      ALT=10000.
      DO 50 I=1,NUMCLD
      DO 40 J=1,NUMTR
      DO 30 K=1,NUMAA
      DO 20 L=1,NUMACH
   75 WRITE(6,150)
      WRITE(6,150)
```

```
      CALL CAMBER(CLDES(I),TR(J),AA(K),XM(L),CL,CD,XLD,IKEY,ALT,COR,D)
      CHORD=COR*D/2
      CALL ATMOS(ALT,RHO,SOS,T)
      V=XM(L)*SOS
      XMUU=(.1E-09)*.3170*T**1.5*734.7/(T+216.)
      RN=RHO*V*CHORD/XMUU
      IF(XM(L) .LT. .3 .OR. XM(L) .GT. 1.6) WRITE (6,202) XM(L)
      IF(IKEY .EQ. 1 .AND. AA(K) .LT. -4.0 .OR. IKEY .EQ. 1 .AND.
     &AA(K) .GT. 8.0)
     &WRITE(6,203) AA(K)
      IF(IKEY .EQ. 2 .AND. CL .LT. 0.0 .OR. IKEY .EQ. 2 .AND.
     &CL .GT. 0.8)
     &WRITE(6,208) CL
      IF (IKEY .EQ. 2) GO TO 5000
      WRITE(6,100) RN,CLDES(I),TR(J),XM(L),AA(K),CL,CD,XLD
      GO TO 20
5000  WRITE(6,125) RN,CLDES(I),TR(J),XM(L),CL,AA(K),CD,XLD
 20   CONTINUE
 30   CONTINUE
 40   CONTINUE
 50   CONTINUE
150    FORMAT(/36H****************************************)
 125  FORMAT(*0REYNOLDS NUMBER=*,E15.3/*0DESIGN CL=*,F5.3,
     &* THICKNESS RATIO=*,F5.3/*0MACH NUMBER=*,F6.3,
     &* CL=*,F6.3/*0ALPHA=*,F6.3,* CD=*,F6.4,* L/D=*,F6.2)
 100  FORMAT(*0REYNOLDS NUMBER=*,E15.3/*0DESIGN CL=*,F5.3,
     &* THICKNESS RATIO=*,F5.3/*0MACH NUMBER=*,F6.3,* ALPHA=*,F7.3/
     &*0CL=*,F6.3,* CD=*,F6.4,* L/D=*,F7.2/)
 202  FORMAT(*0MACH=*,F6.3,* IS OUT OF RANGE OF DATA.
     &*/* EXTRAPOLATION HAS BEEN PERFORMED*)
 203  FORMAT(*0ALPHA=*,F5.2,* IS OUT OF RANGE OF DATA.
     &*/* EXTRAPOLATION HAS BEEN PERFORMED.*)
 208  FORMAT(*0CL=*,F6.4,* IS OUT OF RANGE OF DATA.
     &*/* EXTRAPOLATION HAS BEEN PERFORMED.*)
      END


      SUBROUTINE CAMBER(CLDES,TR,AA,XM,CL,CD,XLD,IKEY,ALT,COR,D)
C
C  THIS SUBROUTINE USES LINEAR INTERPOLATION BETWEEN CAMBERS
C  TO OBTAIN THE AERODYNAMIC CHARACTERISTICS OF A 16-SERIES AIRFOIL.
C  IT USES THE SUBROUTINES AERO0,AERO1,AERO2,...AERO7.
C
C  THE RANGE OF DESIGN CL'S FOR ACCURATE RETURNS IS FROM 0 TO .7.
C
C  DESCRIPTION OF VARIABLES:
C     CLDES=DESIGN LIFT COEFFICIENT
C     TR=MAXIMUM THICKNESS-TO-CHORD RATIO
C     AA=ANGLE OF ATTACK AT BLADE ELEMENT
C     XM=MACH NUMBER AT BLADE ELEMENT
C     CL=SECTION LIFT COEFFICIENT
C     CD=SECTION DRAG COEFFICIENT
C     XLD=LIFT TO DRAG RATIO
C     IKEY=PARAMETER WHICH INDICATES WHETHER PERFORMANCE OR DESIGN
```

```
C           MODE IS DESIRED.
C
C           IF IKEY=1, PROGRAM RUNS IN PERFORMANCE MODE.
C           INPUT IS ANGLE OF ATTACK, MACH NUMBER, DESIGN CL AND
C           THICKNESS RATIO.
C           OUTPUT IS CL, CD, AND L/D.
C
C           IF IKEY=2, PROGRAM RUNS IN DESIGN MODE.
C           INPUT IS CL, MACH NUMBER, DESIGN CL, AND
C           THICKNESS RATIO
C           OUTPUT IS SECTION ANGLE OF ATTACK, CD, AND L/D.
C     ALT=ALTITUDE
C     COR=CHORD/RADIUS OF PROP BLADE
C     D=DIAMETER OF PROPELLER
C
C
      DIMENSION IORDER(2),IPT(2)
      IORDER(1)=IORDER(2)=1
      IPT(1)=-1
      IF (IKEY .EQ. 2) GO TO 2000
      IF (CLDES .LT. 0.0) GO TO 15
      IF (CLDES .GE. 0.0 .AND. CLDES .LT. 0.1) GO TO 25
      IF (CLDES .GE. 0.1 .AND. CLDES .LT. 0.2) GO TO 35
      IF (CLDES .GE. 0.2 .AND. CLDES .LT. 0.3) GO TO 45
      IF (CLDES .GE. 0.3 .AND. CLDES .LT. 0.4) GO TO 55
      IF (CLDES .GE. 0.4 .AND. CLDES .LT. 0.5) GO TO 65
      IF (CLDES .GE. 0.5 .AND. CLDES .LT. 0.6) GO TO 75
      IF (CLDES .GE. 0.6 .AND. CLDES .LT. 0.7) GO TO 85
      IF (CLDES .GE. 0.7) GO TO 95
   15 CALL AERO0(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
      WRITE(6,176) CLDES
  176 FORMAT(* DESIGN CL=*,F5.2,* IS OUT OF RANGE OF DATA.*/
     &* VALUES FOR CLDES=0.0 HAVE BEEN RETURNED.*)
      GO TO 300
   25 CALL AERO0(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
      CL0=CL
      CD0=CD
      IPT(1)=-1
      CALL AERO1(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
      CL1=CL
      CD1=CD
      CL=CL0+(CL1-CL0)*((CLDES-0.0)/(.1-0.0))
      CD=CD0+(CD1-CD0)*((CLDES-0.0)/(.1-0.0))
      GO TO 300
   35 CALL AERO1(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
      CL1=CL
      CD1=CD
      IPT(1)=-1
      CALL AERO2(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
      CL2=CL
      CD2=CD
      CL=CL1+(CL2-CL1)*((CLDES-.1)/(.2-.1))
      CD=CD1+(CD2-CD1)*((CLDES-.1)/(.2-.1))
      GO TO 300
   45 CALL AERO2(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
```

```
      CL2=CL
      CD2=CD
      IPT(1)=-1
      CALL AERO3(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
      CL3=CL
      CD3=CD
      CL=CL2+(CL3-CL2)*((CLDES-.2)/(.3-.2))
      CD=CD2+(CD3-CD2)*((CLDES-.2)/(.3-.2))
      GO TO 300
   55 CALL AERO3(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
      CL3=CL
      CD3=CD
      IPT(1)=-1
      CALL AERO4(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
      CL4=CL
      CD4=CD
      CL=CL3+(CL4-CL3)*((CLDES-.3)/(.4-.3))
      CD=CD3+(CD4-CD3)*((CLDES-.3)/(.4-.3))
      GO TO 300
   65 CALL AERO4(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
      CL4=CL
      CD4=CD
      IPT(1)=-1
      CALL AERO5(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
      CL5=CL
      CD5=CD
      CL=CL4+(CL5-CL4)*((CLDES-.4)/(.5-.4))
      CD=CD4+(CD5-CD4)*((CLDES-.4)/(.5-.4))
      GO TO 300
   75 CALL AERO5(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
      CL5=CL
      CD5=CD
      IPT(1)=-1
      CALL AERO6(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
      CL6=CL
      CD6=CD
      CL=CL5+(CL6-CL5)*((CLDES-.5)/(.6-.5))
      CD=CD5+(CD6-CD5)*((CLDES-.5)/(.6-.5))
      GO TO 300
   85 CALL AERO6(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
      CL6=CL
      CD6=CD
      IPT(1)=-1
      CALL AERO7(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
      CL7=CL
      CD7=CD
      CL=CL6+(CL7-CL6)*((CLDES-.6)/(.7-.6))
      CD=CD6+(CD7-CD6)*((CLDES-.6)/(.7-.6))
      GO TO 300
   95 CALL AERO7(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
      IF (CLDES .GT. 0.7) WRITE(6,175) CLDES
  175 FORMAT(* DESIGN CL=*,F5.3,* IS OUT OF RANGE OF DATA.*/
     &* VALUES FOR CLDES=.7 HAVE BEEN RETURNED.*)
      GO TO 300
 2000 CONTINUE
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```
      IPT(1)=-1
      IF (CLDES .LT. 0.0) GO TO 16
      IF (CLDES .GE. 0.0 .AND. CLDES .LT. 0.1) GO TO 26
      IF (CLDES .GE. 0.1 .AND. CLDES .LT. 0.2) GO TO 36
      IF (CLDES .GE. 0.2 .AND. CLDES .LT. 0.3) GO TO 46
      IF (CLDES .GE. 0.3 .AND. CLDES .LT. 0.4) GO TO 56
      IF (CLDES .GE. 0.4 .AND. CLDES .LT. 0.5) GO TO 66
      IF (CLDES .GE. 0.5 .AND. CLDES .LT. 0.6) GO TO 76
      IF (CLDES .GE. 0.6 .AND. CLDES .LT. 0.7) GO TO 86
      IF (CLDES .GE. 0.7) GO TO 96
   16 CALL AERO0(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
      WRITE(6,178)CLDES
  178 FORMAT(* DESIGN CL =*,F5.2,*'IS OUT OF RANGE OF DATA.*/
     &* THE VALUES FOR CLDES = 0.0 HAVE BEEN RETURNED.*)
      GO TO 300
   26 CALL AERO0(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
      AA0=AA
      CD0=CD
      IPT(1)=-1
      CALL AERO1(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
      AA1=AA
      CD1=CD
      AA=AA0+(AA1-AA0)*((CLDES-0.0)/(.1-0.0))
      CD=CD0+(CD1-CD0)*((CLDES-0.0)/(.1-0.0))
      GO TO 300
   36 CALL AERO1(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
      AA1=AA
      CD1=CD
      IPT(1)=-1
      CALL AERO2(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
      AA2=AA
      CD2=CD
      AA=AA1+(AA2-AA1)*((CLDES-.1)/(.2-.1))
      CD=CD1+(CD2-CD1)*((CLDES-.1)/(.2-.1))
      GO TO 300
   46 CALL AERO2(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
      AA2=AA
      CD2=CD
      IPT(1)=-1
      CALL AERO3(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
      AA3=AA
      CD3=CD
      AA=AA2+(AA3-AA2)*((CLDES-.2)/(.3-.2))
      CD=CD2+(CD3-CD2)*((CLDES-.2)/(.3-.2))
      GO TO 300
   56 CALL AERO3(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
      AA3=AA
      CD3=CD
      IPT(1)=-1
      CALL AERO4(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
      AA4=AA
      CD4=CD
      AA=AA3+(AA4-AA3)*((CLDES-.3)/(.4-.3))
      CD=CD3+(CD4-CD3)*((CLDES-.3)/(.4-.3))
      GO TO 300
```

```
   66 CALL AERO4(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
      AA4=AA
      CD4=CD
      IPT(1)=-1
      CALL AERO5(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
      AA5=AA
      CD5=CD
      AA=AA4+(AA5-AA4)*((CLDES-.4)/(.5-.4))
      CD=CD4+(CD5-CD4)*((CLDES-.4)/(.5-.4))
      GO TO 300
   76 CALL AERO5(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
      AA5=AA
      CD5=CD
      IPT(1)=-1
      CALL AERO6(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
      AA6=AA
      CD6=CD
      AA=AA5+(AA6-AA5)*((CLDES-.5)/(.6-.5))
      CD=CD5+(CD6-CD5)*((CLDES-.5)/(.6-.5))
      GO TO 300
   86 CALL AERO6(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
      AA6=AA
      CD6=CD
      IPT(1)=-1
      CALL AERO7(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
      AA7=AA
      CD7=CD
      AA=AA6+(AA7-AA6)*((CLDES-.6)/(.7-.6))
      CD=CD6+(CD7-CD6)*((CLDES-.6)/(.6-.7))
      GO TO 300
   96 CALL AERO7(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
      IF (CLDES .GT. 0.7) WRITE(6,179) CLDES
  179 FORMAT(* DESIGN CL =*,F5.2,* IS OUT OF RANGE OF DATA.*/
     &* THE VALUES FOR CLDES = .7 HAVE BEEN RETURNED.*)
  300 XLD=CL/CD
      RETURN
      END


      SUBROUTINE AERO0 (XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
C
C
C THIS SUBROUTINE IS DESIGNED TO COMPUTE THE AIRFOIL
C  CHARACTERISTICS FOR A 16 SERIES AIRFOIL WITH A GIVEN CAMBER.
C
C THIS SUBROUTINE RELATES CL,CD,CL/CD,MACH,T/C,AND ALPHA.
C IT REPRESENTS THE DATA OF A 16-0XX AIRFOIL.
C
C XM=RELATIVE MACH NO. AT BLADE ELEMENT
C AA=ANGLE OF ATTACK IN DEGREES
C IKEY1: CL=CL(MACH,ALPHA,T/C)
C      : CD=CD(MACH,CL,T/C)
C      :XLD=CL/CD
C IKEY2: ALPHA=ALPHA(MACH,CL,T/C)
```

```
C       : CD=CD(MACH,CL,T/C)
C       :XLD=CL/CD
C TR=T/C
C
C
C
C
      DIMENSION IORDER(2),IPT(2),ALP004(26,9),ALP006(26,9),
     & ALP009(26,9),ALP012(26,9),ALP015(26,9),ALP018(26,9),
     & ALP021(26,9),CLI(9),XMI(26),ALPI(7),CL004(7,26),
     & CL006(7,26),CL009(7,26),CL012(7,26),CL015(7,26),
     & CL018(7,26),CL021(7,26),CD004(5,26),CD006(5,26),
     & CD009(5,26),CD012(5,26),CD015(5,26),CD018(5,26),
     & CD021(5,26),CLII(5)
      DATA((CL004(I,J),J=1,26),I=1,4)/
     1 -.395, -.392, -.390, -.390, -.389, -.391, -.392, -.394, -.394,
     1 -.384, -.373, -.357, -.340, -.334, -.341, -.353, -.353, -.351,
     1 -.348, -.343, -.340, -.340, -.342, -.412, -.418, -.418,
     2 -.193, -.190, -.188, -.186, -.184, -.183, -.181, -.179, -.168,
     2 -.154, -.138, -.121, -.114, -.121, -.126, -.131, -.133, -.130,
     2 -.125, -.120, -.117, -.115, -.126, -.190, -.206, -.212,
     3  .010,  .013,  .024,  .033,  .044,  .052,  .061,  .072,  .084,
     3  .097,  .109,  .109,  .103,  .098,  .095,  .091,  .088,  .088,
     3  .092,  .100,  .108,  .108,  .095,  .036,  .014,  .007,
     4  .206,  .227,  .251,  .264,  .282,  .291,  .299,  .306,  .313,
     4  .323,  .327,  .323,  .319,  .312,  .306,  .302,  .298,  .298,
     4  .300,  .310,  .317,  .315,  .304,  .195,  .143,  .128/
      DATA((CL004(I,J),J=1,26),I=5,7)/
     5  .419,  .439,  .464,  .485,  .515,  .532,  .546,  .555,  .552,
     5  .548,  .541,  .535,  .528,  .522,  .516,  .511,  .506,  .506,
     5  .515,  .522,  .528,  .527,  .519,  .356,  .274,  .235,
     6  .612,  .659,  .722,  .762,  .803,  .812,  .814,  .814,  .804,
     6  .794,  .784,  .774,  .764,  .756,  .751,  .745,  .741,  .739,
     6  .747,  .761,  .772,  .776,  .763,  .571,  .405,  .342,
     7  .773,  .817,  .876,  .918,  .942,  .942,  .939,  .928,  .917,
     7  .906,  .894,  .883,  .875,  .867,  .861,  .855,  .850,  .850,
     7  .860,  .871,  .877,  .878,  .871,  .683,  .539,  .455/
      DATA((CL006(I,J),J=1,26),I=1,4)/
     1 -.399, -.400, -.401, -.401, -.402, -.402, -.402, -.402, -.399,
     1 -.396, -.394, -.391, -.388, -.386, -.395, -.413, -.426, -.421,
     1 -.410, -.399, -.393, -.401, -.410, -.426, -.428, -.428,
     2 -.197, -.201, -.203, -.198, -.194, -.192, -.189, -.185, -.180,
     2 -.175, -.169, -.162, -.155, -.160, -.167, -.174, -.177, -.174,
     2 -.167, -.166, -.173, -.184, -.195, -.226, -.232, -.232,
     3  .002,  .000, -.001,  .003,  .010,  .015,  .019,  .030,  .041,
     3  .052,  .066,  .080,  .078,  .071,  .064,  .059,  .055,  .058,
     3  .062,  .072,  .074,  .066,  .052, -.019, -.044, -.050,
     4  .192,  .202,  .219,  .230,  .241,  .250,  .258,  .266,  .275,
     4  .283,  .292,  .297,  .287,  .278,  .268,  .259,  .255,  .268,
     4  .280,  .291,  .292,  .279,  .265,  .183,  .140,  .105/
      DATA((CL006(I,J),J=1,26),I=5,7)/
     5  .378,  .400,  .424,  .437,  .464,  .477,  .490,  .503,  .516,
     5  .527,  .524,  .521,  .515,  .502,  .489,  .478,  .476,  .482,
     5  .498,  .514,  .508,  .490,  .471,  .356,  .264,  .212,
     6  .573,  .609,  .665,  .693,  .731,  .750,  .765,  .764,  .760,
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6  .743,  .725,  .706,  .686,  .667,  .651,  .646,  .655,  .666,
6  .678,  .685,  .684,  .661,  .638,  .505,  .388,  .326,
7  .766,  .786,  .804,  .846,  .887,  .906,  .909,  .892,  .875,
7  .858,  .841,  .824,  .807,  .789,  .768,  .749,  .753,  .772,
7  .791,  .798,  .793,  .774,  .754,  .637,  .512,  .424/
 DATA((CL009(I,J),J=1,26),I=1,4)/
1 -.364, -.358, -.352, -.350, -.348, -.345, -.343, -.340, -.337,
1 -.335, -.332, -.329, -.326, -.331, -.345, -.338, -.326, -.319,
1 -.319, -.320, -.322, -.326, -.330, -.348, -.356, -.364,
2 -.192, -.173, -.164, -.160, -.151, -.147, -.143, -.140, -.137,
2 -.137, -.137, -.141, -.144, -.145, -.146, -.145, -.133, -.123,
2 -.124, -.129, -.134, -.139, -.144, -.165, -.190, -.215,
3 -.004, -.004,  .002,  .007,  .013,  .016,  .022,  .027,  .032,
3  .040,  .049,  .057,  .054,  .045,  .041,  .045,  .056,  .067,
3  .063,  .057,  .051,  .046,  .041,  .005, -.024, -.047,
4  .181,  .190,  .202,  .211,  .224,  .231,  .237,  .244,  .251,
4  .257,  .264,  .266,  .252,  .233,  .216,  .223,  .238,  .253,
4  .258,  .252,  .245,  .237,  .230,  .184,  .144,  .122/
 DATA((CL009(I,J),J=1,26),I=5,7)/
5  .385,  .393,  .409,  .420,  .439,  .452,  .465,  .478,  .491,
5  .499,  .486,  .461,  .433,  .406,  .385,  .394,  .420,  .448,
5  .459,  .449,  .438,  .426,  .413,  .340,  .276,  .226,
6  .558,  .601,  .641,  .672,  .704,  .723,  .715,  .702,  .680,
6  .655,  .630,  .604,  .579,  .551,  .532,  .544,  .569,  .593,
6  .609,  .596,  .582,  .569,  .555,  .473,  .406,  .341,
7  .698,  .756,  .804,  .832,  .865,  .858,  .847,  .826,  .805,
7  .783,  .749,  .716,  .682,  .648,  .611,  .617,  .643,  .670,
7  .690,  .678,  .666,  .651,  .637,  .558,  .493,  .435/
 DATA((CL012(I,J),J=1,26),I=1,4)/
1 -.400, -.400, -.401, -.402, -.403, -.403, -.403, -.402, -.401,
1 -.400, -.397, -.394, -.400, -.416, -.406, -.387, -.387, -.388,
1 -.389, -.390, -.391, -.393, -.394, -.400, -.400, -.397,
2 -.201, -.202, -.203, -.203, -.204, -.203, -.202, -.200, -.197,
2 -.195, -.193, -.192, -.214, -.227, -.211, -.187, -.186, -.184,
2 -.186, -.188, -.189, -.191, -.193, -.203, -.217, -.227,
3 -.004, -.006, -.007, -.007, -.002,  .002,  .006,  .009,  .013,
3  .015,  .015,  .007, -.019, -.036, -.020,  .003,  .015,  .014,
3  .012,  .010,  .009,  .007,  .005, -.004, -.019, -.027,
4  .192,  .192,  .195,  .201,  .208,  .211,  .215,  .217,  .218,
4  .213,  .204,  .185,  .167,  .161,  .179,  .195,  .206,  .209,
4  .202,  .195,  .189,  .182,  .177,  .158,  .139,  .129/
 DATA((CL012(I,J),J=1,26),I=5,7)/
5  .343,  .363,  .379,  .390,  .406,  .415,  .424,  .436,  .445,
5  .442,  .424,  .387,  .341,  .317,  .343,  .379,  .411,  .419,
5  .412,  .397,  .383,  .369,  .356,  .302,  .266,  .233,
6  .510,  .537,  .567,  .587,  .619,  .635,  .643,  .631,  .602,
6  .570,  .536,  .495,  .455,  .441,  .465,  .495,  .524,  .537,
6  .529,  .517,  .504,  .492,  .480,  .425,  .384,  .351,
7  .627,  .672,  .715,  .745,  .777,  .784,  .762,  .739,  .694,
7  .649,  .601,  .549,  .505,  .494,  .522,  .549,  .576,  .586,
7  .578,  .570,  .562,  .556,  .550,  .517,  .488,  .458/
 DATA((CL015(I,J),J=1,26),I=1,4)/
1 -.400, -.402, -.402, -.403, -.403, -.399, -.395, -.390, -.387,
1 -.384, -.386, -.401, -.431, -.417, -.382, -.376, -.379, -.383,
1 -.387, -.388, -.389, -.390, -.391, -.396, -.403, -.420,
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2 -.204, -.207, -.209, -.209, -.209, -.201, -.192, -.183, -.175,
2 -.168, -.178, -.202, -.223, -.221, -.184, -.164, -.166, -.173,
2 -.181, -.183, -.186, -.189, -.191, -.207, -.223, -.243,
3 -.004, -.009, -.006,  .003,  .014,  .020,  .025,  .029,  .032,
3  .031,  .008, -.024, -.045, -.028, -.001,  .032,  .041,  .038,
3  .035,  .032,  .028,  .025,  .022,  .002, -.017, -.040,
4  .179,  .182,  .191,  .196,  .208,  .214,  .219,  .225,  .231,
4  .216,  .181,  .146,  .133,  .151,  .187,  .222,  .226,  .221,
4  .216,  .211,  .205,  .200,  .195,  .169,  .150,  .130/
 DATA((CL015(I,J),J=1,26),I=5,7)/
5  .310,  .325,  .342,  .355,  .371,  .379,  .389,  .401,  .407,
5  .376,  .322,  .270,  .245,  .272,  .312,  .351,  .366,  .360,
5  .353,  .346,  .338,  .330,  .323,  .287,  .258,  .238,
6  .444,  .473,  .499,  .517,  .539,  .552,  .566,  .575,  .563,
6  .503,  .427,  .363,  .344,  .374,  .415,  .450,  .467,  .464,
6  .459,  .452,  .444,  .436,  .431,  .400,  .374,  .352,
7  .552,  .581,  .618,  .640,  .668,  .672,  .663,  .637,  .594,
7  .537,  .468,  .405,  .379,  .412,  .461,  .497,  .509,  .505,
7  .501,  .497,  .492,  .486,  .481,  .456,  .442,  .431/
 DATA((CL018(I,J),J=1,26),I=1,4)/
1 -.400, -.399, -.398, -.397, -.397, -.397, -.396, -.391, -.387,
1 -.387, -.409, -.426, -.406, -.381, -.358, -.347, -.344, -.344,
1 -.344, -.344, -.344, -.344, -.345, -.348, -.345, -.344,
2 -.177, -.183, -.184, -.184, -.183, -.181, -.179, -.177, -.181,
2 -.197, -.228, -.253, -.221, -.185, -.149, -.131, -.133, -.134,
2 -.135, -.135, -.135, -.135, -.136, -.135, -.141, -.144,
3  .006,  .004,  .003,  .003,  .006,  .010,  .013,  .019,  .023,
3 -.013, -.051, -.077, -.046,  .007,  .063,  .074,  .072,  .069,
3  .065,  .064,  .063,  .063,  .061,  .047,  .035,  .026,
4  .183,  .183,  .190,  .194,  .198,  .200,  .200,  .200,  .189,
4  .153,  .120,  .105,  .140,  .196,  .241,  .259,  .257,  .250,
4  .245,  .243,  .241,  .235,  .229,  .202,  .176,  .160/
 DATA((CL018(I,J),J=1,26),I=5,7)/
5  .317,  .324,  .332,  .341,  .347,  .347,  .348,  .343,  .314,
5  .274,  .235,  .216,  .247,  .299,  .344,  .368,  .366,  .359,
5  .353,  .350,  .346,  .339,  .333,  .307,  .282,  .265,
6  .426,  .444,  .466,  .478,  .494,  .501,  .495,  .463,  .412,
6  .354,  .299,  .273,  .296,  .346,  .398,  .422,  .422,  .417,
6  .412,  .407,  .403,  .400,  .396,  .375,  .354,  .340,
7  .521,  .539,  .566,  .588,  .600,  .599,  .579,  .529,  .465,
7  .398,  .335,  .305,  .331,  .385,  .440,  .458,  .460,  .460,
7  .457,  .454,  .451,  .449,  .447,  .429,  .419,  .413/
 DATA((CL021(I,J),J=1,26),I=1,4)/
1 -.374, -.369, -.367, -.367, -.356, -.346, -.337, -.341, -.355,
1 -.371, -.379, -.366, -.337, -.308, -.286, -.286, -.293, -.302,
1 -.311, -.313, -.316, -.318, -.321, -.325, -.324, -.331,
2 -.185, -.182, -.179, -.174, -.160, -.146, -.139, -.153, -.173,
2 -.194, -.217, -.203, -.169, -.133, -.098, -.077, -.088, -.100,
2 -.112, -.123, -.135, -.141, -.146, -.151, -.157, -.165,
3  .003, -.002,  .006,  .016,  .033,  .029,  .016,  .001, -.014,
3 -.028, -.040, -.027,  .004,  .035,  .075,  .094,  .082,  .069,
3  .056,  .049,  .043,  .036,  .029, -.001, -.013, -.020,
4  .178,  .175,  .191,  .211,  .219,  .204,  .181,  .159,  .136,
4  .108,  .090,  .101,  .134,  .168,  .192,  .194,  .187,  .176,
4  .165,  .155,  .148,  .142,  .135,  .106,  .091,  .086/
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      DATA((CL021(I,J),J=1,26),I=5,7)/
     5  .290,  .294,  .307,  .323,  .318,  .304,  .275,  .246,  .217,
     5  .183,  .158,  .178,  .221,  .270,  .304,  .301,  .289,  .278,
     5  .268,  .258,  .247,  .239,  .231,  .194,  .175,  .158,
     6  .373,  .373,  .384,  .404,  .401,  .379,  .343,  .307,  .271,
     6  .233,  .212,  .229,  .283,  .340,  .377,  .381,  .371,  .361,
     6  .351,  .340,  .330,  .320,  .310,  .275,  .248,  .227,
     7  .456,  .463,  .498,  .522,  .506,  .467,  .418,  .368,  .319,
     7  .270,  .242,  .268,  .320,  .377,  .419,  .424,  .411,  .398,
     7  .388,  .377,  .366,  .356,  .346,  .310,  .287,  .267/
      DATA((ALP004(J,N),N=1,9),J=1,13)/
     & -4.05, -2.07,  -.10,  1.94,  3.82,  5.88,  8.34, 10.82, 13.30,
     & -4.08, -2.10,  -.13,  1.75,  3.63,  5.46,  7.78, 10.32, 12.85,
     & -4.10, -2.12,  -.23,  1.55,  3.40,  5.05,  7.01,  9.61, 12.21,
     & -4.10, -2.14,  -.30,  1.45,  3.23,  4.83,  6.49,  9.05, 11.62,
     & -4.11, -2.16,  -.39,  1.31,  3.01,  4.59,  5.98,  8.83, 11.71,
     & -4.09, -2.16,  -.44,  1.24,  2.90,  4.49,  5.91,  8.89, 11.97,
     & -4.08, -2.18,  -.50,  1.17,  2.82,  4.40,  5.90,  8.98, 12.18,
     & -4.06, -2.20,  -.57,  1.09,  2.76,  4.35,  5.89,  9.26, 12.77,
     & -4.05, -2.28,  -.67,  1.01,  2.73,  4.38,  5.97,  9.47, 13.01,
     & -4.14, -2.40,  -.77,   .91,  2.68,  4.42,  6.11,  9.68, 13.25,
     & -4.23, -2.53,  -.88,   .83,  2.68,  4.49,  6.29,  9.93, 13.56,
     & -4.36, -2.67,  -.95,   .85,  2.73,  4.54,  6.48, 10.15, 13.82,
     & -4.53, -2.76,  -.95,   .90,  2.78,  4.61,  6.65, 10.25, 13.86/
      DATA((ALP004(J,N),N=1,9),J=14,26)/
     & -4.62, -2.74,  -.89,   .95,  2.84,  4.67,  6.79, 10.40, 14.00,
     & -4.55, -2.69,  -.86,  1.00,  2.90,  4.71,  6.89, 10.53, 14.16,
     & -4.42, -2.62,  -.82,  1.03,  2.94,  4.76,  7.00, 10.64, 14.27,
     & -4.43, -2.61,  -.80,  1.07,  2.98,  4.80,  7.08, 10.75, 14.42,
     & -4.44, -2.63,  -.81,  1.07,  2.98,  4.81,  7.10, 10.70, 14.31,
     & -4.47, -2.67,  -.85,  1.04,  2.93,  4.73,  6.94, 10.48, 14.02,
     & -4.51, -2.72,  -.91,   .95,  2.85,  4.65,  6.71, 10.35, 13.98,
     & -4.54, -2.74,  -.96,   .88,  2.79,  4.59,  6.53, 10.34, 14.15,
     & -4.53, -2.76,  -.97,   .89,  2.80,  4.59,  6.47, 10.39, 14.31,
     & -4.54, -2.69,  -.86,  1.00,  2.89,  4.66,  6.69, 10.39, 14.09,
     & -3.89, -2.09,  -.32,  2.06,  4.41,  6.52, 10.09, 13.66, 17.23,
     & -3.83, -1.95,  -.13,  2.87,  5.92,  8.91, 11.90, 14.88, 17.87,
     & -3.83, -1.89,  -.06,  3.35,  7.03, 10.57, 14.11, 17.65, 21.19/
      DATA((ALP006(J,N),N=1,9),J=1,13)/
     & -4.01, -2.03,  -.02,  2.09,  4.23,  6.28,  8.35, 10.42, 12.50,
     & -4.00, -1.99,  0.00,  1.98,  4.00,  5.91,  8.16, 10.42, 12.68,
     & -3.99, -1.97,   .01,  1.83,  3.77,  5.46,  7.94, 10.82, 13.70,
     & -3.99, -2.02,  -.03,  1.74,  3.64,  5.27,  7.40, 10.01, 12.63,
     & -3.98, -2.06,  -.10,  1.65,  3.43,  5.02,  6.88,  9.45, 12.01,
     & -3.98, -2.08,  -.14,  1.57,  3.32,  4.90,  6.64,  9.21, 11.77,
     & -3.98, -2.10,  -.18,  1.51,  3.22,  4.80,  6.49,  9.26, 12.04,
     & -3.98, -2.14,  -.28,  1.44,  3.13,  4.74,  6.56,  9.69, 12.81,
     & -4.01, -2.18,  -.37,  1.36,  3.04,  4.69,  6.70, 10.17, 13.65,
     & -4.04, -2.23,  -.46,  1.28,  2.96,  4.68,  6.99, 10.47, 13.95,
     & -4.05, -2.28,  -.56,  1.19,  2.93,  4.76,  7.29, 10.74, 14.19,
     & -4.08, -2.33,  -.66,  1.11,  2.92,  4.85,  7.59, 10.98, 14.37,
     & -4.10, -2.39,  -.67,  1.17,  2.99,  4.99,  7.88, 11.19, 14.50/
      DATA((ALP006(J,N),N=1,9),J=14,26)/
     & -4.12, -2.35,  -.61,  1.25,  3.09,  5.19,  8.18, 11.46, 14.74,
     & -4.04, -2.29,  -.55,  1.33,  3.19,  5.37,  8.55, 11.97, 15.38,
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     & -3.89, -2.22,  -.51,  1.41,  3.29,  5.45,  8.99, 12.87, 16.76,
     & -3.79, -2.18,  -.47,  1.45,  3.31,  5.39,  8.96, 13.04, 17.12,
     & -3.83, -2.21,  -.50,  1.35,  3.23,  5.28,  8.53, 12.30, 16.08,
     & -3.92, -2.27,  -.54,  1.27,  3.10,  5.13,  8.16, 11.70, 15.24,
     & -4.01, -2.29,  -.61,  1.17,  2.98,  5.01,  8.04, 11.58, 15.12,
     & -4.06, -2.25,  -.60,  1.16,  3.00,  5.05,  8.13, 11.80, 15.47,
     & -3.99, -2.15,  -.53,  1.26,  3.15,  5.29,  8.46, 12.00, 15.54,
     & -3.91, -2.05,  -.42,  1.39,  3.31,  5.54,  8.79, 12.24, 15.69,
     & -3.74, -1.75,   .19,  2.20,  4.59,  7.44, 10.47, 13.50, 16.53,
     & -3.71, -1.66,   .48,  2.97,  6.19,  9.42, 12.65, 15.87, 19.10,
     & -3.71, -1.65,   .65,  3.78,  7.51, 11.59, 15.67, 19.76, 23.84/
      DATA((ALP009(J,N),N=1,9),J=1,13)/
     & -4.42, -2.09,   .04,  2.19,  4.17,  6.60,  9.46, 12.31, 15.17,
     & -4.45, -2.29,   .04,  2.10,  4.07,  5.99,  8.57, 11.15, 13.73,
     & -4.51, -2.38,  -.02,  1.98,  3.91,  5.65,  7.95, 10.40, 12.86,
     & -4.53, -2.42,  -.08,  1.89,  3.81,  5.43,  7.60, 10.10, 12.60,
     & -4.53, -2.50,  -.16,  1.77,  3.64,  5.22,  7.19,  9.68, 12.16,
     & -4.56, -2.54,  -.20,  1.71,  3.53,  5.09,  7.14, 10.10, 13.07,
     & -4.57, -2.57,  -.27,  1.66,  3.43,  5.08,  7.29, 10.32, 13.35,
     & -4.60, -2.60,  -.32,  1.59,  3.33,  5.09,  7.58, 10.81, 14.03,
     & -4.63, -2.63,  -.38,  1.53,  3.24,  5.15,  7.92, 11.12, 14.32,
     & -4.66, -2.64,  -.45,  1.47,  3.18,  5.29,  8.27, 11.39, 14.52,
     & -4.70, -2.65,  -.53,  1.40,  3.23,  5.58,  8.86, 12.22, 15.58,
     & -4.76, -2.63,  -.58,  1.37,  3.37,  5.94,  9.50, 13.07, 16.64,
     & -4.81, -2.62,  -.55,  1.47,  3.64,  6.41, 10.29, 14.17, 18.06/
      DATA((ALP009(J,N),N=1,9),J=14,26)/
     & -4.74, -2.59,  -.47,  1.65,  3.93,  7.01, 11.13, 15.26, 19.38,
     & -4.55, -2.54,  -.44,  1.82,  4.20,  7.72, 12.78, 17.85, 22.91,
     & -4.64, -2.57,  -.47,  1.74,  4.08,  7.53, 13.01, 18.49, 23.97,
     & -4.77, -2.69,  -.59,  1.58,  3.78,  6.84, 12.24, 17.65, 23.05,
     & -4.83, -2.79,  -.71,  1.43,  3.51,  6.18, 11.38, 16.57, 21.77,
     & -4.83, -2.78,  -.67,  1.41,  3.41,  5.88, 10.72, 15.65, 20.59,
     & -4.84, -2.74,  -.61,  1.47,  3.50,  6.10, 10.98, 15.85, 20.73,
     & -4.83, -2.70,  -.55,  1.54,  3.61,  6.43, 11.19, 15.95, 20.71,
     & -4.79, -2.65,  -.50,  1.61,  3.72,  6.76, 11.63, 16.51, 21.39,
     & -4.75, -2.60,  -.44,  1.68,  3.86,  7.10, 11.98, 16.85, 21.73,
     & -4.57, -2.38,  -.06,  2.21,  4.90,  8.99, 13.69, 18.40, 23.11,
     & -4.53, -2.12,   .29,  2.85,  5.91, 10.46, 15.06, 19.66, 24.25,
     & -4.48, -1.82,   .56,  3.50,  7.26, 11.51, 15.77, 20.02, 24.28/
      DATA((ALP012(J,N),N=1,9),J=1,13)/
     & -4.00, -1.99,   .04,  2.11,  4.68,  7.54, 10.96, 14.38, 17.79,
     & -4.00, -1.98,   .06,  2.09,  4.43,  6.93,  9.90, 12.86, 15.82,
     & -3.99, -1.97,   .07,  2.05,  4.22,  6.45,  9.15, 11.85, 14.55,
     & -3.98, -1.97,   .07,  1.99,  4.10,  6.16,  8.70, 11.23, 13.76,
     & -3.97, -1.96,   .02,  1.92,  3.94,  5.82,  8.29, 10.82, 13.35,
     & -3.97, -1.97,  -.02,  1.89,  3.85,  5.68,  8.21, 10.90, 13.58,
     & -3.97, -1.98,  -.06,  1.86,  3.77,  5.61,  8.64, 12.00, 15.36,
     & -3.98, -2.00,  -.09,  1.84,  3.67,  5.68,  9.13, 12.83, 16.54,
     & -3.99, -2.03,  -.12,  1.82,  3.60,  5.97, 10.30, 14.65, 19.00,
     & -4.00, -2.05,  -.14,  1.87,  3.63,  6.76, 11.82, 16.89, 21.95,
     & -4.03, -2.07,  -.14,  1.96,  3.78,  7.97, 14.12, 20.28, 26.43,
     & -4.06, -2.08,  -.07,  2.15,  4.24,  9.89, 17.30, 24.70, 32.11,
     & -4.00, -1.86,   .20,  2.38,  5.04, 11.80, 19.80, 27.80, 35.80/
      DATA((ALP012(J,N),N=1,9),J=14,26)/
     & -3.83, -1.72,   .37,  2.50,  5.34, 12.00, 19.55, 27.09, 34.64,
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     & -3.94, -1.88,   .20,  2.26,  4.93, 10.74, 17.75, 24.77, 31.79,
     & -4.13, -2.13,  -.03,  2.05,  4.36,  9.89, 17.30, 24.70, 32.11,
     & -4.13, -2.14,  -.15,  1.94,  3.89,  8.92, 16.62, 24.31, 32.00,
     & -4.12, -2.16,  -.14,  1.91,  3.82,  8.57, 16.73, 24.90, 33.06,
     & -4.11, -2.14,  -.12,  1.98,  3.89,  8.90, 17.06, 25.22, 33.39,
     & -4.10, -2.12,  -.10,  2.05,  4.05,  9.13, 16.68, 24.23, 31.77,
     & -4.09, -2.11,  -.09,  2.11,  4.28,  9.31, 16.21, 23.10, 30.00,
     & -4.07, -2.09,  -.07,  2.19,  4.50,  9.38, 15.63, 21.88, 28.13,
     & -4.06, -2.07,  -.05,  2.26,  4.71,  9.43, 15.14, 20.86, 26.57,
     & -4.00, -1.97,   .05,  2.58,  5.59,  9.80, 14.15, 18.50, 22.85,
     & -4.00, -1.83,   .24,  2.96,  6.31, 10.15, 14.00, 17.85, 21.69,
     & -4.04, -1.73,   .35,  3.37,  6.92, 10.65, 14.39, 18.13, 21.87/
      DATA((ALP015(J,N),N=1,9),J=1,13)/
     & -4.00, -1.96,   .04,  2.32,  5.34,  8.89, 12.59, 16.30, 20.00,
     & -3.98, -1.93,   .09,  2.25,  5.01,  8.35, 12.06, 15.76, 19.46,
     & -3.98, -1.91,   .06,  2.12,  4.74,  7.70, 11.06, 14.42, 17.78,
     & -3.97, -1.92,  -.03,  2.05,  4.56,  7.35, 10.60, 13.85, 17.11,
     & -3.97, -1.92,  -.13,  1.92,  4.35,  6.95, 10.05, 13.15, 16.25,
     & -4.01, -1.99,  -.18,  1.86,  4.24,  6.80, 10.13, 13.47, 16.80,
     & -4.05, -2.08,  -.23,  1.80,  4.12,  6.70, 10.82, 14.95, 19.07,
     & -4.10, -2.16,  -.27,  1.74,  3.99,  6.81, 13.26, 19.71, 26.16,
     & -4.12, -2.24,  -.31,  1.69,  3.92,  8.39, 21.29, 34.19, 47.10,
     & -4.15, -2.30,  -.31,  1.83,  4.38, 11.71, 23.47, 35.24, 47.00,
     & -4.13, -2.21,  -.09,  2.27,  5.49, 14.44, 24.20, 33.95, 43.71,
     & -3.99, -1.98,   .28,  2.87,  7.76, 17.29, 26.81, 36.33, 45.86,
     & -3.70, -1.74,   .51,  3.20,  9.20, 20.63, 32.06, 43.49, 54.91/
      DATA((ALP015(J,N),N=1,9),J=14,26)/
     & -3.83, -1.78,   .31,  2.81,  7.37, 17.89, 28.42, 38.95, 49.47,
     & -4.18, -2.16,   .01,  2.21,  5.71, 14.04, 22.74, 31.43, 40.13,
     & -4.23, -2.34,  -.33,  1.77,  4.99, 12.38, 20.89, 29.40, 37.91,
     & -4.20, -2.32,  -.40,  1.72,  4.67, 12.33, 21.86, 31.38, 40.90,
     & -4.16, -2.26,  -.36,  1.77,  4.77, 12.63, 22.39, 32.15, 41.90,
     & -4.13, -2.18,  -.32,  1.82,  4.89, 12.71, 22.24, 31.76, 41.29,
     & -4.12, -2.17,  -.30,  1.88,  5.02, 12.58, 21.47, 30.36, 39.24,
     & -4.11, -2.14,  -.26,  1.94,  5.17, 12.50, 20.83, 29.17, 37.50,
     & -4.10, -2.11,  -.23,  2.00,  5.32, 12.56, 20.56, 28.56, 36.56,
     & -4.09, -2.09,  -.21,  2.09,  5.43, 12.76, 20.76, 28.76, 36.76,
     & -4.04, -1.93,  -.02,  2.53,  6.00, 13.14, 20.29, 27.43, 34.57,
     & -3.97, -1.78,   .20,  2.93,  6.76, 12.65, 18.53, 24.41, 30.29,
     & -3.77, -1.58,   .47,  3.30,  7.22, 12.24, 17.34, 22.41, 27.47/
      DATA((ALP018(J,N),N=1,9),J=1,13)/
     & -4.00, -2.21,  -.07,  2.25,  5.52,  9.66, 13.87, 18.08, 22.29,
     & -4.01, -2.16,  -.04,  2.24,  5.27,  9.28, 13.49, 17.71, 21.92,
     & -4.02, -2.15,  -.03,  2.14,  5.01,  8.68, 12.68, 16.68, 20.68,
     & -4.03, -2.15,  -.03,  2.08,  4.86,  8.22, 11.85, 15.49, 19.13,
     & -4.03, -2.16,  -.06,  2.03,  4.72,  8.00, 11.77, 15.55, 19.32,
     & -4.03, -2.18,  -.10,  2.00,  4.69,  8.02, 12.10, 16.18, 20.27,
     & -4.04, -2.19,  -.14,  2.00,  4.71,  8.50, 13.26, 18.02, 22.79,
     & -4.08, -2.21,  -.19,  2.00,  4.95, 10.15, 16.21, 22.27, 28.33,
     & -4.13, -2.18,  -.23,  2.18,  5.76, 13.09, 20.64, 28.19, 35.74,
     & -4.14, -2.03,   .16,  2.78,  8.09, 17.18, 26.27, 35.36, 44.45,
     & -3.90, -1.68,   .60,  3.39, 11.61, 22.72, 33.83, 44.94, 56.06,
     & -3.70, -1.40,   .85,  3.71, 13.94, 26.44, 38.94, 51.44, 63.94,
     & -3.94, -1.76,   .49,  3.12, 11.94, 23.37, 34.80, 46.23, 57.66/
      DATA((ALP018(J,N),N=1,9),J=14,26)/
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     &  -4.19,  -2.15,   -.07,   2.08,   8.77,  19.03,  29.28,  39.54,  49.79,
     &  -4.40,  -2.49,   -.59,   1.54,   6.10,  15.62,  25.14,  34.67,  44.19,
     &  -4.49,  -2.64,   -.72,   1.36,   5.19,  15.89,  27.00,  38.11,  49.22,
     &  -4.53,  -2.64,   -.70,   1.38,   5.21,  15.37,  25.89,  36.42,  46.95,
     &  -4.53,  -2.63,   -.68,   1.45,   5.41,  14.51,  23.81,  33.12,  42.42,
     &  -4.54,  -2.62,   -.65,   1.50,   5.59,  14.36,  23.24,  32.13,  41.02,
     &  -4.54,  -2.62,   -.64,   1.52,   5.75,  14.21,  22.72,  31.23,  39.74,
     &  -4.54,  -2.62,   -.64,   1.54,   5.89,  14.21,  22.54,  30.88,  39.21,
     &  -4.54,  -2.62,   -.64,   1.59,   6.00,  14.16,  22.33,  30.49,  38.65,
     &  -4.53,  -2.61,   -.62,   1.65,   6.16,  14.00,  21.84,  29.69,  37.53,
     &  -4.49,  -2.61,   -.52,   1.97,   6.93,  14.33,  21.74,  29.15,  36.56,
     &  -4.54,  -2.58,   -.40,   2.45,   7.42,  13.57,  19.72,  25.88,  32.03,
     &  -4.56,  -2.56,   -.31,   2.76,   7.64,  13.12,  18.60,  24.08,  29.56/
      DATA((ALP021(J,N),N=1,9),J=1,13)/
     &  -4.28,  -2.16,   -.03,   2.39,   6.65,  11.47,  16.29,  21.11,  25.93,
     &  -4.33,  -2.19,    .02,   2.42,   6.60,  11.04,  15.49,  19.93,  24.38,
     &  -4.35,  -2.22,   -.06,   2.16,   6.28,   9.79,  13.30,  16.81,  20.32,
     &  -4.34,  -2.27,   -.17,   1.89,   5.90,   9.32,  12.71,  16.10,  19.49,
     &  -4.45,  -2.41,   -.34,   1.80,   5.98,   9.79,  13.60,  17.41,  21.22,
     &  -4.54,  -2.54,   -.33,   1.95,   6.48,  11.02,  15.57,  20.11,  24.66,
     &  -4.64,  -2.62,   -.21,   2.40,   7.52,  12.85,  18.19,  23.52,  28.85,
     &  -4.63,  -2.50,   -.01,   2.94,   9.05,  15.61,  22.16,  28.72,  35.28,
     &  -4.49,  -2.30,    .19,   3.58,  11.38,  19.71,  28.04,  36.38,  44.71,
     &  -4.33,  -2.07,    .41,   4.68,  15.03,  25.84,  36.65,  47.46,  58.27,
     &  -4.26,  -1.81,    .62,   5.56,  18.53,  31.87,  45.20,  58.53,  71.87,
     &  -4.42,  -1.97,    .42,   4.86,  14.77,  25.03,  35.28,  45.54,  55.79,
     &  -4.75,  -2.37,   -.05,   3.52,  12.32,  23.14,  33.95,  44.76,  55.57/
      DATA((ALP021(J,N),N=1,9),J=14,26)/
     &  -5.05,  -2.77,   -.42,   2.63,   9.24,  20.05,  30.86,  41.68,  52.49,
     &  -5.21,  -3.09,   -.87,   2.14,   7.10,  16.62,  26.14,  35.67,  45.19,
     &  -5.09,  -3.18,  -1.10,   2.11,   6.88,  16.19,  25.49,  34.79,  44.09,
     &  -5.04,  -3.09,   -.96,   2.25,   7.45,  17.45,  27.45,  37.45,  47.45,
     &  -4.97,  -2.99,   -.82,   2.47,   8.11,  18.92,  29.73,  40.54,  51.35,
     &  -4.89,  -2.88,   -.67,   2.68,   8.65,  19.46,  30.27,  41.08,  51.89,
     &  -4.92,  -2.81,   -.57,   2.87,   9.24,  20.05,  30.86,  41.68,  52.49,
     &  -4.93,  -2.72,   -.48,   3.05,   9.89,  21.00,  32.11,  43.22,  54.33,
     &  -4.93,  -2.67,   -.41,   3.20,  10.44,  21.56,  32.67,  43.78,  54.89,
     &  -4.90,  -2.62,   -.33,   3.35,  11.00,  22.11,  33.22,  44.33,  55.44,
     &  -4.86,  -2.56,    .02,   4.15,  13.14,  24.57,  36.00,  47.43,  58.86,
     &  -4.91,  -2.51,    .25,   4.68,  13.79,  24.05,  34.31,  44.56,  54.82,
     &  -4.83,  -2.42,    .38,   5.22,  14.65,  24.65,  34.65,  44.65,  54.65/
      DATA((CD004(I,J),J=1,26),I=1,5)/
     1  .0046,  .0046,  .0046,  .0046,  .0046,  .0046,  .0046,  .0046,  .0046,
     1  .0046,  .0046,  .0046,  .0047,  .0061,  .0111,  .0161,  .0200,  .0221,
     1  .0225,  .0226,  .0226,  .0225,  .0220,  .0185,  .0159,  .0149,
     2  .0066,  .0065,  .0064,  .0064,  .0064,  .0065,  .0065,  .0065,  .0065,
     2  .0065,  .0066,  .0070,  .0077,  .0088,  .0138,  .0196,  .0234,  .0253,
     2  .0264,  .0267,  .0271,  .0274,  .0275,  .0280,  .0278,  .0274,
     3  .0177,  .0144,  .0126,  .0122,  .0117,  .0115,  .0115,  .0116,  .0116,
     3  .0116,  .0118,  .0119,  .0135,  .0181,  .0237,  .0293,  .0340,  .0370,
     3  .0387,  .0405,  .0417,  .0428,  .0439,  .0501,  .0565,  .0632,
     4  .0446,  .0359,  .0305,  .0278,  .0272,  .0293,  .0321,  .0349,  .0377,
     4  .0405,  .0439,  .0482,  .0524,  .0567,  .0609,  .0651,  .0694,  .0736,
     4  .0772,  .0805,  .0838,  .0871,  .0904,  .1047,  .1141,  .1216,
     5  .0877,  .0599,  .0537,  .0569,  .0623,  .0651,  .0691,  .0759,  .0826,
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5 .0894, .0969, .1051, .1133, .1215, .1282, .1332, .1382, .1432,
5 .1471, .1496, .1526, .1553, .1580, .1707, .1792, .1826/
 DATA((CD006(I,J),J=1,26),I=1,5)/
1 .0044, .0044, .0044, .0044, .0044, .0044, .0044, .0045, .0046,
1 .0047, .0049, .0053, .0071, .0142, .0218, .0261, .0287, .0293,
1 .0297, .0301, .0302, .0301, .0300, .0284, .0261, .0238,
2 .0070, .0069, .0069, .0069, .0069, .0068, .0068, .0068, .0068,
2 .0069, .0074, .0084, .0117, .0188, .0244, .0283, .0311, .0330,
2 .0344, .0348, .0352, .0356, .0360, .0365, .0358, .0338,
3 .0149, .0137, .0131, .0128, .0124, .0123, .0121, .0120, .0118,
3 .0119, .0128, .0145, .0185, .0253, .0321, .0375, .0406, .0427,
3 .0444, .0459, .0473, .0488, .0502, .0582, .0662, .0743,
4 .0384, .0314, .0267, .0237, .0217, .0213, .0223, .0244, .0275,
4 .0316, .0388, .0460, .0532, .0625, .0736, .0825, .0897, .0951,
4 .0982, .1013, .1037, .1052, .1066, .1153, .1239, .1326,
5 .0699, .0522, .0515, .0546, .0615, .0650, .0684, .0719, .0753,
5 .0815, .0881, .0947, .1013, .1121, .1265, .1408, .1553, .1711,
5 .1792, .1816, .1839, .1862, .1886, .2025, .2153, .2261/
 DATA((CD009(I,J),J=1,26),I=1,5)/
1 .0044, .0044, .0044, .0044, .0044, .0044, .0044, .0044, .0044,
1 .0044, .0045, .0061, .0096, .0148, .0224, .0312, .0379, .0428,
1 .0457, .0485, .0508, .0527, .0533, .0506, .0464, .0422,
2 .0063, .0064, .0064, .0065, .0066, .0066, .0067, .0067, .0069,
2 .0076, .0092, .0135, .0196, .0266, .0337, .0399, .0450, .0490,
2 .0517, .0539, .0555, .0565, .0569, .0569, .0556, .0542,
3 .0120, .0123, .0124, .0124, .0125, .0125, .0125, .0126, .0126,
3 .0132, .0151, .0223, .0302, .0385, .0460, .0524, .0558, .0592,
3 .0619, .0640, .0661, .0682, .0697, .0773, .0842, .0910,
4 .0251, .0242, .0238, .0236, .0236, .0237, .0237, .0238, .0250,
4 .0298, .0374, .0470, .0575, .0685, .0800, .0905, .0993, .1048,
4 .1102, .1146, .1189, .1232, .1275, .1388, .1422, .1432,
5 .0502, .0466, .0435, .0422, .0439, .0467, .0517, .0602, .0688,
5 .0773, .0865, .0968, .1067, .1161, .1254, .1347, .1439, .1532,
5 .1606, .1669, .1732, .1787, .1842, .1957, .1957, .1957/
 DATA((CD012(I,J),J=1,26),I=1,5)/
1 .0059, .0059, .0059, .0059, .0059, .0059, .0059, .0059, .0059,
1 .0061, .0067, .0139, .0242, .0357, .0468, .0558, .0616, .0666,
1 .0695, .0724, .0738, .0749, .0756, .0768, .0764, .0717,
2 .0084, .0084, .0085, .0085, .0085, .0085, .0085, .0085, .0085,
2 .0094, .0164, .0263, .0365, .0471, .0553, .0614, .0676, .0708,
2 .0737, .0765, .0785, .0795, .0805, .0849, .0854, .0843,
3 .0151, .0149, .0148, .0149, .0149, .0150, .0152, .0154, .0163,
3 .0209, .0297, .0385, .0478, .0582, .0670, .0746, .0803, .0850,
3 .0894, .0927, .0961, .0992, .1008, .1082, .1126, .1160,
4 .0233, .0251, .0260, .0265, .0268, .0270, .0272, .0287, .0323,
4 .0471, .0637, .0790, .0929, .1037, .1114, .1190, .1256, .1314,
4 .1372, .1417, .1448, .1479, .1508, .1637, .1693, .1744,
5 .0347, .0401, .0416, .0422, .0450, .0488, .0542, .0636, .0792,
5 .0947, .1116, .1300, .1484, .1626, .1742, .1859, .1923, .1953,
5 .1982, .2011, .2016, .2016, .2016, .2016, .2016, .2016/
 DATA((CD015(I,J),J=1,26),I=1,5)/
1 .0071, .0065, .0062, .0061, .0060, .0060, .0060, .0061, .0070,
1 .0138, .0219, .0356, .0497, .0633, .0764, .0861, .0958, .1016,
1 .1074, .1119, .1155, .1179, .1187, .1182, .1099, .1009,
2 .0104, .0105, .0107, .0109, .0111, .0112, .0114, .0123, .0148,
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2 .0235, .0331, .0449, .0567, .0685, .0792, .0892, .0967, .1039,
2 .1110, .1163, .1196, .1228, .1248, .1260, .1205, .1119,
3 .0197, .0203, .0206, .0207, .0209, .0209, .0210, .0212, .0235,
3 .0323, .0438, .0558, .0664, .0772, .0881, .0975, .1063, .1135,
3 .1198, .1261, .1305, .1335, .1365, .1463, .1521, .1545,
4 .0275, .0322, .0346, .0358, .0370, .0382, .0398, .0442, .0546,
4 .0684, .0806, .0925, .1048, .1172, .1283, .1376, .1468, .1537,
4 .1598, .1659, .1700, .1735, .1770, .1925, .2025, .2126,
5 .0399, .0476, .0514, .0534, .0553, .0579, .0626, .0751, .0897,
5 .1073, .1266, .1438, .1596, .1753, .1879, .2002, .2124, .2232,
5 .2317, .2403, .2488, .2550, .2598, .2697, .2697, .2697/
 DATA((CD018(I,J),J=1,26),I=1,5)/
1 .0081, .0089, .0097, .0100, .0104, .0106, .0108, .0110, .0112,
1 .0187, .0348, .0526, .0693, .0845, .0983, .1096, .1173, .1232,
1 .1277, .1308, .1339, .1354, .1359, .1358, .1341, .1320,
2 .0112, .0152, .0173, .0183, .0193, .0198, .0205, .0220, .0268,
2 .0421, .0566, .0715, .0845, .0966, .1071, .1165, .1242, .1294,
2 .1346, .1398, .1420, .1442, .1463, .1521, .1553, .1586,
3 .0197, .0267, .0302, .0319, .0337, .0350, .0367, .0392, .0462,
3 .0575, .0695, .0817, .0930, .1037, .1143, .1248, .1344, .1391,
3 .1438, .1486, .1522, .1542, .1563, .1683, .1804, .1925,
4 .0346, .0484, .0538, .0564, .0595, .0614, .0660, .0767, .0923,
4 .1108, .1297, .1489, .1631, .1738, .1808, .1858, .1908, .1945,
4 .1977, .2008, .2040, .2069, .2095, .2250, .2406, .2561,
5 .0553, .0739, .0830, .0876, .0944, .0981, .1051, .1139, .1329,
5 .1562, .1864, .2150, .2351, .2502, .2625, .2713, .2800, .2888,
5 .2976, .3035, .3085, .3135, .3184, .3429, .3535, .3642/
 DATA((CD021(I,J),J=1,26),I=1,5)/
1 .0093, .0113, .0123, .0129, .0135, .0137, .0142, .0167, .0277,
1 .0405, .0535, .0665, .0795, .0915, .1024, .1133, .1242, .1343,
1 .1421, .1500, .1578, .1656, .1714, .1816, .1804, .1775,
2 .0136, .0172, .0190, .0199, .0208, .0213, .0224, .0307, .0401,
2 .0499, .0620, .0741, .0861, .0982, .1103, .1224, .1328, .1424,
2 .1520, .1617, .1713, .1757, .1786, .1857, .1857, .1857,
3 .0280, .0332, .0358, .0371, .0383, .0398, .0421, .0501, .0605,
3 .0719, .0837, .0959, .1087, .1215, .1331, .1446, .1561, .1677,
3 .1793, .1836, .1878, .1919, .1961, .2031, .2021, .2010,
4 .0566, .0668, .0730, .0772, .0814, .0840, .0884, .0973, .1132,
4 .1291, .1449, .1577, .1702, .1826, .1920, .2005, .2089, .2173,
4 .2257, .2320, .2358, .2396, .2433, .2509, .2530, .2551,
5 .1044, .1234, .1329, .1376, .1423, .1446, .1610, .1781, .1953,
5 .2125, .2285, .2444, .2604, .2764, .2898, .2941, .2983, .3026,
5 .3069, .3091, .3088, .3084, .3081, .3062, .3042, .3023/
 DATA(XMI(J),J=1,26)/.3,.5,.6,.65,.7,.725,.75,.775,
& .8,.825,.85,.875,.9,.925,.95,.975,1.0,1.025,1.05,1.075,
&1.1,1.125,1.15,1.3,1.45,1.6/
 DATA(CLI(J),J=1,9)/-.4,-.2,0.0,.2,.4,.6,.8,1.0,1.2/
 DATA(ALPI(J),J=1,7)/-4.0,-2.0,0.0,2.0,4.0,6.0,8.0/
 DATA(CLII(J),J=1,5)/0.0,.2,.4,.6,.8/
 IORDER(1)=IORDER(2)=1
 IPT (1) = -1
 IF (IKEY .EQ. 2) GO TO 1000
 IF (TR .LT. .04) GO TO 9
 IF (TR .GE. .04 .AND. TR .LT. .06) GO TO 1
 IF (TR .GE. .06 .AND. TR .LT. .09) GO TO 2
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      IF (TR .GE. .09 .AND. TR .LT. .12) GO TO 3
      IF (TR .GE. .12 .AND. TR .LT. .15) GO TO 4
      IF (TR .GE. .15 .AND. TR .LT. .18) GO TO 5
      IF (TR .GE. .18 .AND. TR .LT. .21) GO TO 6
      IF (TR .GE. .21) GO TO 7
    9 CALL IBI (7,ALPI,26,XMI,7,CL004,IORDER,IPT,AA,XM,CLFT04,IERR)
      CL=CLFT04
      GO TO 400
    1 CALL IBI (7,ALPI,26,XMI,7,CL004,IORDER,IPT,AA,XM,CLFT04,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL006,IORDER,IPT,AA,XM,CLFT06,IERR)
      CL=CLFT04 + (CLFT06-CLFT04)*((TR-.04)/(.06-.04))
      GO TO 400
    2 CALL IBI (7,ALPI,26,XMI,7,CL006,IORDER,IPT,AA,XM,CLFT06,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL009,IORDER,IPT,AA,XM,CLFT09,IERR)
      CL=CLFT06 + (CLFT09 - CLFT06)*((TR-.06)/(.09-.06))
      GO TO 400
    3 CALL IBI (7,ALPI,26,XMI,7,CL009,IORDER,IPT,AA,XM,CLFT09,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL012,IORDER,IPT,AA,XM,CLFT12,IERR)
      CL=CLFT09+(CLFT12-CLFT09)*((TR-.09)/(.12-.09))
      GO TO 400
    4 CALL IBI (7,ALPI,26,XMI,7,CL012,IORDER,IPT,AA,XM,CLFT12,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL015,IORDER,IPT,AA,XM,CLFT15,IERR)
      CL=CLFT12 + (CLFT15-CLFT12)*((TR-.12)/(.15-.12))
      GO TO 400
    5 CALL IBI (7,ALPI,26,XMI,7,CL015,IORDER,IPT,AA,XM,CLFT15,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL018,IORDER,IPT,AA,XM,CLFT18,IERR)
      CL=CLFT15+(CLFT18-CLFT15)*((TR-.15)/(.18-.15))
      GO TO 400
    6 CALL IBI (7,ALPI,26,XMI,7,CL018,IORDER,IPT,AA,XM,CLFT18,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL021,IORDER,IPT,AA,XM,CLFT21,IERR)
      CL=CLFT18+(CLFT21-CLFT18)*((TR-.18)/(.21-.18))
      GO TO 400
    7 CALL IBI (7,ALPI,26,XMI,7,CL021,IORDER,IPT,AA,XM,CLFT21,IERR)
      CL=CLFT21
      GO TO 400
 1000 CONTINUE
      IPT (1)=-1
      IF (TR .LT. .04) GO TO 90
      IF (TR .GE. .04 .AND. TR .LT. .06) GO TO 10
      IF (TR .GE. .06 .AND. TR .LT. .09) GO TO 20
      IF (TR .GE. .09 .AND. TR .LT. .12) GO TO 30
      IF (TR .GE. .12 .AND. TR .LT. .15) GO TO 40
      IF (TR .GE. .15 .AND. TR .LT. .18) GO TO 50
      IF (TR .GE. .18 .AND. TR .LT. .21) GO TO 60
      IF (TR .GE. .21) GO TO 70
   90 CALL IBI (26,XMI,9,CLI,26,ALP004,IORDER,IPT,XM,CL,AA04,IERR)
      AA=AA04
      GO TO 400
   10 CALL IBI (26,XMI,9,CLI,26,ALP004,IORDER,IPT,XM,CL,AA04,IERR)
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      IPT (1) = -1
      CALL IBI (26,XMI,9,CLI,26,ALP006,IORDER,IPT,XM,CL,AA06,IERR)
      AA=AA04 + (AA06-AA04)*((TR-.04)/(.06-.04))
      GO TO 400
   20 CALL IBI (26,XMI,9,CLI,26,ALP006,IORDER,IPT,XM,CL,AA06,IERR)
      IPT (1) = -1
      CALL IBI (26,XMI,9,CLI,26,ALP009,IORDER,IPT,XM,CL,AA09,IERR)
      AA=AA06 + (AA09 - AA06)*((TR -.06)/(.09-.06))
      GO TO 400
   30 CALL IBI (26,XMI,9,CLI,26,ALP009,IORDER,IPT,XM,CL,AA09,IERR)
      IPT (1) = -1
      CALL IBI (26,XMI,9,CLI,26,ALP012,IORDER,IPT,XM,CL,AA12,IERR)
      AA=AA09+(AA12-AA09)*((TR-.09)/(.12-.09))
      GO TO 400
   40 CALL IBI (26,XMI,9,CLI,26,ALP012,IORDER,IPT,XM,CL,AA12,IERR)
      IPT(1)=-1
      CALL IBI (26,XMI,9,CLI,26,ALP015,IORDER,IPT,XM,CL,AA15,IERR)
      AA=AA12+(AA15-AA12)*((TR-.12)/(.15-.12))
      GO TO 400
   50 CALL IBI (26,XMI,9,CLI,26,ALP015,IORDER,IPT,XM,CL,AA15,IERR)
      IPT(1)=-1
      CALL IBI (26,XMI,9,CLI,26,ALP018,IORDER,IPT,XM,CL,AA18,IERR)
      AA=AA15+(AA18-AA15)*((TR-.15)/(.18-.15))
      GO TO 400
   60 CALL IBI (26,XMI,9,CLI,26,ALP018,IORDER,IPT,XM,CL,AA18,IERR)
      IPT(1)=-1
      CALL IBI (26,XMI,9,CLI,26,ALP021,IORDER,IPT,XM,CL,AA21,IERR)
      AA=AA18+(AA21-AA18)*((TR-.18)/(.21-.18))
      GO TO 400
   70 CALL IBI (26,XMI,9,CLI,26,ALP021,IORDER,IPT,XM,CL,AA21,IERR)
      AA=AA21
  400 CONTINUE
      IPT (1)=-1
      IF (TR .LT. .04) GO TO 91
      IF (TR .GE. .04 .AND. TR .LT. .06) GO TO 11
      IF (TR .GE. .06 .AND. TR .LT. .09) GO TO 21
      IF (TR .GE. .09 .AND. TR .LT. .12) GO TO 31
      IF (TR .GE. .12 .AND. TR .LT. .15) GO TO 41
      IF (TR .GE. .15 .AND. TR .LT. .18) GO TO 51
      IF (TR .GE. .18 .AND. TR .LT. .21) GO TO 61
      IF (TR .GE. .21) GO TO 71
   91 CALL IBI (5,CLII,26,XMI,5,CD004,IORDER,IPT,CL,XM,CDRG04,IERR)
      CD=CDRG04
      WRITE (6,201) TR
  201 FORMAT(*0THICKNESS RATIO=*,F5.3,* IS OUT OF RANGE.
     &*/* THE VALUES FOR T/C=.04 HAVE BEEN RETURNED*)
      GO TO 250
   11 CALL IBI (5,CLII,26,XMI,5,CD004,IORDER,IPT,CL,XM,CDRG04,IERR)
      IPT(1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD006,IORDER,IPT,CL,XM,CDRG06,IERR)
      CD=CDRG04+(CDRG06-CDRG04)*((TR-.04)/(.06-.04))
      GO TO 250
   21 CALL IBI (5,CLII,26,XMI,5,CD006,IORDER,IPT,CL,XM,CDRG06,IERR)
      IPT (1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD009,IORDER,IPT,CL,XM,CDRG09,IERR)
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      CD=CDRG06 + (CDRG09 - CDRG06)*((TR-.06)/(.09-.06))
      GO TO 250
   31 CALL IBI (5,CLII,26,XMI,5,CD009,IORDER,IPT,CL,XM,CDRG09,IERR)
      IPT (1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD012,IORDER,IPT,CL,XM,CDRG12,IERR)
      CD=CDRG09+(CDRG12-CDRG09)*((TR-.09)/(.12-.09))
      GO TO 250
   41 CALL IBI (5,CLII,26,XMI,5,CD012,IORDER,IPT,CL,XM,CDRG12,IERR)
      IPT(1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD015,IORDER,IPT,CL,XM,CDRG15,IERR)
      CD=CDRG12+(CDRG15-CDRG12)*((TR-.12)/(.15-.12))
      GO TO 250
   51 CALL IBI (5,CLII,26,XMI,5,CD015,IORDER,IPT,CL,XM,CDRG15,IERR)
      IPT(1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD018,IORDER,IPT,CL,XM,CDRG18,IERR)
      CD=CDRG15+(CDRG18-CDRG15)*((TR-.15)/(.18-.15))
      GO TO 250
   61 CALL IBI (5,CLII,26,XMI,5,CD018,IORDER,IPT,CL,XM,CDRG18,IERR)
      IPT(1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD021,IORDER,IPT,CL,XM,CDRG21,IERR)
      CD=CDRG18+(CDRG21-CDRG18)*((TR-.18)/(.21-.18))
      GO TO 250
   71 CALL IBI (5,CLII,26,XMI,5,CD021,IORDER,IPT,CL,XM,CDRG21,IERR)
      CD=CDRG21
      IF (TR .GT. .21) WRITE (6,204) TR
  204 FORMAT(*0THICKNESS RATIO=*,F5.3,* IS OUT OF RANGE.
     &*/* THE VALUES FOR T/C=.21 HAVE BEEN RETURNED.*)
  250 IF (CL .GT. .8) GO TO 251
      RETURN
  251 CALL COMPUT(D,XM,ALT,COR,TR,AA,CDT,CL,CD,CLDES)
      CD=CDT
      RETURN
      END


      SUBROUTINE AERO1(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
C
C
C THIS SUBROUTINE IS DESIGNED TO COMPUTE THE AIRFOIL
C  CHARACTERISTIC FOR A 16 SERIES AIRFOIL WITH A GIVEN CAMBER.
C
C THIS SUBROUTINE RELATES CL,CD,CL/CD,MACH,T/C,AND ALPHA.
C IT REPRESENTS THE DATA OF A 16-1XX AIRFOIL.
C
C XM=RELATIVE MACH NO. AT BLADE ELEMENT
C AA=ANGLE OF ATTACK IN DEGREES
C IKEY1: CL=CL(MACH,ALPHA,T/C)
C      : CD=CD(MACH,CL,T/C)
C      :XLD=CL/CD
C IKEY2: ALPHA=ALPHA(MACH,CL,T/C)
C      : CD=CD(MACH,CL,T/C)
C      :XLD=CL/CD
C TR=T/C
C
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C
C
C
      DIMENSION IORDER(2),IPT(2),ALP104(26,9),ALP106(26,9),
     & ALP109(26,9),ALP112(26,9),ALP115(26,9),ALP118(26,9),
     & ALP121(26,9),CLI(9),XMI(26),ALPI(7),CL104(7,26),
     & CL106(7,26),CL109(7,26),CL112(7,26),CL115(7,26),
     & CL118(7,26),CL121(7,26),CD104(5,26),CD106(5,26),
     & CD109(5,26),CD112(5,26),CD115(5,26),CD118(5,26),
     & CD121(5,26),CLII(5)
      DATA((CL104(I,J),J=1,26),I=1,4)/
     1 -.302, -.302, -.302, -.302, -.304, -.308, -.312, -.315, -.317,
     1 -.318, -.318, -.306, -.294, -.277, -.261, -.247, -.247, -.262,
     1 -.262, -.258, -.256, -.256, -.256, -.317, -.324, -.308,
     2 -.099, -.116, -.125, -.131, -.138, -.144, -.149, -.155, -.161,
     2 -.161, -.155, -.138, -.112, -.085, -.068, -.066, -.082, -.081,
     2 -.079, -.072, -.067, -.069, -.072, -.128, -.133, -.128,
     3  .095,  .098,  .108,  .117,  .126,  .130,  .134,  .141,  .147,
     3  .154,  .161,  .167,  .175,  .183,  .190,  .182,  .165,  .155,
     3  .158,  .168,  .176,  .183,  .175,  .057, -.009, -.014,
     4  .301,  .318,  .339,  .355,  .378,  .389,  .400,  .412,  .424,
     4  .436,  .448,  .459,  .467,  .460,  .450,  .433,  .416,  .407,
     4  .415,  .430,  .445,  .450,  .430,  .246,  .136,  .104/
      DATA((CL104(I,J),J=1,26),I=5,7)/
     5  .504,  .536,  .562,  .585,  .622,  .639,  .656,  .669,  .678,
     5  .681,  .677,  .669,  .661,  .651,  .641,  .634,  .629,  .631,
     5  .642,  .656,  .669,  .675,  .656,  .410,  .255,  .215,
     6  .698,  .744,  .791,  .827,  .864,  .874,  .877,  .874,  .868,
     6  .858,  .848,  .838,  .829,  .821,  .813,  .807,  .803,  .808,
     6  .816,  .832,  .848,  .854,  .828,  .564,  .389,  .321,
     7  .852,  .893,  .971, 1.017, 1.042, 1.037, 1.026, 1.015, 1.003,
     7  .989,  .975,  .961,  .950,  .941,  .933,  .924,  .919,  .918,
     7  .924,  .935,  .955,  .964,  .934,  .697,  .521,  .438/
      DATA((CL106(I,J),J=1,26),I=1,4)/
     1 -.301, -.301, -.301, -.296, -.291, -.290, -.289, -.289, -.288,
     1 -.285, -.283, -.280, -.277, -.272, -.282, -.305, -.320, -.311,
     1 -.299, -.288, -.281, -.282, -.288, -.314, -.321, -.311,
     2 -.083, -.088, -.086, -.083, -.079, -.077, -.074, -.072, -.070,
     2 -.066, -.063, -.060, -.057, -.071, -.103, -.124, -.130, -.111,
     2 -.090, -.070, -.060, -.070, -.084, -.124, -.134, -.132,
     3  .105,  .116,  .129,  .135,  .142,  .147,  .152,  .157,  .162,
     3  .167,  .172,  .178,  .184,  .175,  .151,  .123,  .118,  .131,
     3  .153,  .171,  .168,  .155,  .143,  .072,  .021,  .003,
     4  .313,  .329,  .348,  .359,  .377,  .385,  .395,  .408,  .420,
     4  .433,  .445,  .446,  .431,  .411,  .392,  .377,  .376,  .392,
     4  .415,  .436,  .437,  .421,  .396,  .257,  .159,  .112/
      DATA((CL106(I,J),J=1,26),I=5,7)/
     5  .502,  .529,  .558,  .585,  .614,  .634,  .655,  .669,  .666,
     5  .654,  .641,  .624,  .608,  .592,  .577,  .564,  .565,  .581,
     5  .604,  .625,  .621,  .603,  .571,  .398,  .278,  .221,
     6  .684,  .731,  .782,  .823,  .872,  .877,  .864,  .849,  .831,
     6  .814,  .796,  .779,  .761,  .744,  .729,  .717,  .715,  .731,
     6  .750,  .769,  .769,  .743,  .712,  .529,  .405,  .331,
     7  .820,  .869,  .934,  .989, 1.008, 1.002,  .991,  .971,  .951,
     7  .931,  .911,  .891,  .871,  .851,  .834,  .820,  .829,  .845,
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7  .867,  .885,  .883,  .865,  .837,  .667,  .536,  .440/
 DATA((CL109(I,J),J=1,26),I=1,4)/
1 -.273, -.294, -.310, -.322, -.336, -.344, -.352, -.360, -.370,
1 -.379, -.387, -.394, -.402, -.409, -.422, -.424, -.384, -.349,
1 -.328, -.323, -.323, -.325, -.327, -.336, -.341, -.338,
2 -.077, -.081, -.094, -.103, -.112, -.118, -.124, -.130, -.137,
2 -.145, -.153, -.161, -.170, -.180, -.188, -.178, -.148, -.123,
2 -.108, -.108, -.109, -.111, -.113, -.125, -.136, -.139,
3  .099,  .099,  .099,  .103,  .107,  .110,  .113,  .117,  .120,
3  .124,  .127,  .130,  .118,  .089,  .065,  .071,  .089,  .106,
3  .119,  .119,  .109,  .100,  .090,  .043,  .016,  .008,
4  .298,  .322,  .334,  .337,  .351,  .358,  .365,  .372,  .379,
4  .384,  .387,  .378,  .339,  .298,  .266,  .283,  .310,  .337,
4  .360,  .353,  .339,  .325,  .310,  .225,  .157,  .125/
 DATA((CL109(I,J),J=1,26),I=5,7)/
5  .465,  .492,  .519,  .536,  .557,  .571,  .585,  .598,  .605,
5  .593,  .559,  .524,  .490,  .456,  .430,  .447,  .476,  .505,
5  .528,  .518,  .500,  .481,  .462,  .362,  .283,  .226,
6  .638,  .673,  .708,  .738,  .783,  .812,  .814,  .800,  .776,
6  .741,  .704,  .667,  .627,  .584,  .564,  .588,  .615,  .645,
6  .667,  .655,  .635,  .616,  .596,  .493,  .414,  .346,
7  .762,  .818,  .868,  .906,  .949,  .948,  .929,  .898,  .866,
7  .828,  .788,  .749,  .709,  .671,  .649,  .668,  .694,  .720,
7  .745,  .733,  .717,  .701,  .686,  .596,  .517,  .450/
 DATA((CL112(I,J),J=1,26),I=1,4)/
1 -.276, -.274, -.272, -.274, -.276, -.277, -.278, -.279, -.280,
1 -.281, -.282, -.294, -.340, -.373, -.362, -.306, -.301, -.303,
1 -.305, -.308, -.310, -.313, -.315, -.334, -.349, -.361,
2 -.086, -.094, -.095, -.094, -.093, -.093, -.093, -.094, -.096,
2 -.097, -.099, -.121, -.171, -.203, -.186, -.141, -.098, -.094,
2 -.097, -.099, -.102, -.105, -.109, -.128, -.143, -.148,
3  .084,  .093,  .098,  .101,  .104,  .105,  .107,  .111,  .116,
3  .119,  .103,  .071,  .034,  .014,  .028,  .055,  .082,  .104,
3  .093,  .083,  .073,  .063,  .053,  .013, -.010, -.014,
4  .283,  .287,  .298,  .303,  .311,  .315,  .319,  .324,  .328,
4  .321,  .297,  .255,  .211,  .183,  .204,  .240,  .277,  .298,
4  .287,  .272,  .258,  .243,  .229,  .165,  .125,  .095/
 DATA((CL112(I,J),J=1,26),I=5,7)/
5  .421,  .444,  .467,  .479,  .496,  .504,  .512,  .521,  .528,
5  .509,  .470,  .415,  .360,  .330,  .345,  .382,  .420,  .439,
5  .429,  .415,  .399,  .383,  .367,  .294,  .248,  .207,
6  .581,  .608,  .640,  .663,  .700,  .719,  .734,  .717,  .680,
6  .630,  .579,  .528,  .484,  .454,  .481,  .514,  .556,  .571,
6  .557,  .542,  .526,  .510,  .494,  .415,  .357,  .314,
7  .692,  .712,  .749,  .778,  .831,  .855,  .847,  .824,  .784,
7  .721,  .658,  .595,  .534,  .513,  .527,  .566,  .607,  .629,
7  .618,  .607,  .597,  .586,  .575,  .510,  .461,  .415/
 DATA((CL115(I,J),J=1,26),I=1,4)/
1 -.285, -.285, -.288, -.289, -.291, -.292, -.292, -.292, -.292,
1 -.292, -.305, -.345, -.383, -.361, -.301, -.281, -.280, -.279,
1 -.279, -.280, -.281, -.282, -.282, -.289, -.296, -.302,
2 -.104, -.117, -.128, -.134, -.138, -.140, -.142, -.147, -.152,
2 -.157, -.168, -.217, -.248, -.227, -.165, -.124, -.124, -.124,
2 -.124, -.124, -.124, -.124, -.124, -.135, -.147, -.157,
3  .073,  .070,  .071,  .072,  .075,  .077,  .079,  .082,  .081,
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3  .064,  .023, -.018, -.043, -.023,  .019,  .057,  .069,  .067,
3  .063,  .059,  .054,  .050,  .046,  .026,  .008, -.010,
4  .263,  .265,  .275,  .281,  .291,  .296,  .301,  .308,  .313,
4  .284,  .212,  .146,  .129,  .158,  .204,  .250,  .270,  .261,
4  .250,  .240,  .231,  .222,  .212,  .161,  .125,  .099/
 DATA((CL115(I,J),J=1,26),I=5,7)/
5  .388,  .410,  .428,  .438,  .459,  .471,  .481,  .489,  .474,
5  .410,  .347,  .284,  .250,  .287,  .329,  .372,  .394,  .384,
5  .374,  .364,  .354,  .344,  .334,  .279,  .233,  .204,
6  .516,  .541,  .568,  .589,  .613,  .628,  .645,  .648,  .604,
6  .526,  .448,  .376,  .342,  .366,  .415,  .462,  .480,  .469,
6  .457,  .444,  .432,  .423,  .414,  .365,  .331,  .306,
7  .628,  .657,  .688,  .711,  .741,  .759,  .752,  .722,  .658,
7  .575,  .491,  .415,  .388,  .416,  .466,  .512,  .526,  .516,
7  .506,  .496,  .487,  .477,  .468,  .419,  .382,  .355/
 DATA((CL118(I,J),J=1,26),I=1,4)/
1 -.252, -.255, -.255, -.265, -.280, -.288, -.296, -.310, -.328,
1 -.344, -.359, -.371, -.375, -.344, -.312, -.289, -.278, -.277,
1 -.280, -.283, -.286, -.289, -.289, -.293, -.296, -.298,
2 -.111, -.122, -.135, -.145, -.156, -.161, -.167, -.185, -.205,
2 -.223, -.241, -.250, -.228, -.191, -.151, -.137, -.135, -.135,
2 -.138, -.141, -.144, -.147, -.148, -.151, -.150, -.157,
3  .047,  .040,  .042,  .044,  .055,  .057,  .057,  .053,  .024,
3 -.024, -.071, -.094, -.071, -.024,  .024,  .043,  .040,  .038,
3  .035,  .032,  .029,  .027,  .024,  .009, -.006, -.013,
4  .218,  .226,  .235,  .240,  .246,  .250,  .247,  .226,  .186,
4  .132,  .072,  .047,  .082,  .148,  .209,  .232,  .224,  .217,
4  .209,  .201,  .193,  .185,  .178,  .148,  .119,  .099/
 DATA((CL118(I,J),J=1,26),I=5,7)/
5  .352,  .358,  .371,  .383,  .401,  .405,  .390,  .362,  .311,
5  .248,  .179,  .169,  .208,  .274,  .333,  .344,  .339,  .335,
5  .329,  .321,  .313,  .305,  .298,  .262,  .226,  .203,
6  .454,  .467,  .498,  .516,  .556,  .559,  .529,  .456,  .383,
6  .311,  .253,  .244,  .283,  .341,  .397,  .419,  .411,  .404,
6  .396,  .389,  .381,  .374,  .367,  .326,  .295,  .272,
7  .546,  .569,  .599,  .630,  .669,  .664,  .619,  .543,  .461,
7  .365,  .288,  .272,  .306,  .366,  .424,  .453,  .446,  .438,
7  .431,  .423,  .416,  .410,  .403,  .363,  .329,  .305/
 DATA((CL121(I,J),J=1,26),I=1,4)/
1 -.393, -.391, -.390, -.382, -.374, -.371, -.364, -.376, -.390,
1 -.419, -.438, -.420, -.371, -.305, -.252, -.254, -.259, -.265,
1 -.271, -.277, -.283, -.289, -.295, -.305, -.318, -.328,
2 -.174, -.174, -.170, -.166, -.152, -.145, -.135, -.151, -.179,
2 -.211, -.213, -.189, -.134, -.078, -.042, -.036, -.040, -.048,
2 -.056, -.064, -.072, -.080, -.088, -.127, -.148, -.151,
3  .019,  .019,  .020,  .026,  .032,  .030,  .015, -.015, -.045,
3 -.075, -.090, -.066,  .006,  .093,  .124,  .122,  .120,  .113,
3  .107,  .100,  .093,  .087,  .080,  .046,  .020,  .002,
4  .186,  .186,  .191,  .197,  .211,  .210,  .183,  .130,  .076,
4  .030,  .007,  .035,  .115,  .193,  .220,  .216,  .209,  .202,
4  .196,  .189,  .183,  .176,  .169,  .132,  .101,  .077/
 DATA((CL121(I,J),J=1,26),I=5,7)/
5  .281,  .284,  .286,  .299,  .325,  .332,  .306,  .244,  .172,
5  .113,  .100,  .126,  .207,  .283,  .314,  .309,  .303,  .294,
5  .286,  .277,  .269,  .260,  .252,  .212,  .182,  .160,
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6  .386,  .386,  .398,  .414,  .450,  .435,  .398,  .316,  .234,
6  .171,  .159,  .185,  .258,  .333,  .366,  .363,  .359,  .351,
6  .343,  .335,  .328,  .320,  .312,  .269,  .233,  .205,
7  .452,  .472,  .501,  .538,  .553,  .516,  .456,  .384,  .287,
7  .204,  .180,  .205,  .285,  .350,  .389,  .393,  .386,  .380,
7  .373,  .366,  .360,  .353,  .346,  .301,  .265,  .235/
 DATA((ALP104(J,N),N=1,9),J=1,13)/
& -4.97, -3.00,  -.98,  1.02,  2.98,  4.99,  7.32,  9.92, 12.52,
& -5.05, -2.90,  -.92,   .93,  2.75,  4.62,  6.75,  9.44, 12.12,
& -5.11, -2.85,  -.93,   .80,  2.55,  4.33,  6.10,  8.32, 10.54,
& -5.15, -2.81,  -.94,   .70,  2.39,  4.12,  5.78,  7.82,  9.93,
& -5.16, -2.75,  -.95,   .59,  2.18,  3.82,  5.47,  7.53,  9.78,
& -5.12, -2.68,  -.95,   .54,  2.09,  3.69,  5.37,  7.55, 10.00,
& -5.08, -2.63,  -.95,   .50,  2.00,  3.56,  5.30,  7.65, 10.34,
& -5.06, -2.56,  -.95,   .44,  1.91,  3.46,  5.28,  7.79, 10.62,
& -5.06, -2.50,  -.95,   .38,  1.83,  3.39,  5.28,  7.96, 10.92,
& -5.04, -2.50,  -.98,   .33,  1.74,  3.34,  5.34,  8.17, 11.22,
& -5.01, -2.55, -1.02,   .27,  1.67,  3.33,  5.44,  8.39, 11.54,
& -5.12, -2.74, -1.10,   .23,  1.60,  3.34,  5.55,  8.63, 11.89,
& -5.16, -2.97, -1.22,   .17,  1.54,  3.37,  5.65,  8.83, 12.13/
 DATA((ALP104(J,N),N=1,9),J=14,26)/
& -5.28, -3.20, -1.37,   .12,  1.57,  3.47,  5.75,  8.98, 12.32,
& -5.44, -3.37, -1.47,   .08,  1.62,  3.57,  5.85,  9.12, 12.45,
& -5.69, -3.48, -1.47,   .14,  1.74,  3.66,  5.92,  9.30, 12.72,
& -5.85, -3.43, -1.34,   .28,  1.87,  3.73,  5.97,  9.40, 12.84,
& -5.52, -3.31, -1.31,   .36,  1.94,  3.72,  5.91,  9.49, 13.13,
& -5.51, -3.32, -1.33,   .33,  1.88,  3.63,  5.82,  9.41, 13.11,
& -5.53, -3.38, -1.40,   .24,  1.77,  3.50,  5.64,  9.26, 13.15,
& -5.52, -3.41, -1.45,   .18,  1.67,  3.38,  5.46,  8.84, 12.58,
& -5.54, -3.40, -1.45,   .13,  1.63,  3.33,  5.40,  8.65, 12.29,
& -5.57, -3.39, -1.42,   .20,  1.76,  3.50,  5.67,  9.25, 13.02,
& -4.88, -2.76,  -.62,  1.51,  3.88,  6.54,  9.55, 12.56, 15.56,
& -4.80, -2.70,   .12,  3.08,  6.17,  9.20, 12.23, 15.26, 18.29,
& -5.02, -2.80,   .24,  3.73,  7.35, 10.77, 14.19, 17.61, 21.03/
 DATA((ALP106(J,N),N=1,9),J=1,13)/
& -4.91, -3.07, -1.12,   .91,  2.92,  5.08,  7.71, 10.65, 13.59,
& -4.93, -3.05, -1.14,   .79,  2.71,  4.70,  7.00,  9.90, 12.80,
& -4.92, -3.06, -1.20,   .65,  2.50,  4.38,  6.24,  8.87, 11.50,
& -4.98, -3.10, -1.24,   .58,  2.36,  4.13,  5.81,  8.13, 10.54,
& -5.03, -3.14, -1.29,   .49,  2.19,  3.88,  5.44,  7.88, 10.82,
& -5.03, -3.15, -1.31,   .45,  2.12,  3.73,  5.37,  7.97, 11.17,
& -5.03, -3.17, -1.35,   .40,  2.04,  3.58,  5.39,  8.14, 11.29,
& -5.02, -3.18, -1.37,   .34,  1.94,  3.47,  5.46,  8.48, 11.75,
& -5.03, -3.19, -1.40,   .29,  1.84,  3.46,  5.62,  8.82, 12.15,
& -5.05, -3.22, -1.43,   .25,  1.75,  3.51,  5.83,  9.18, 12.60,
& -5.06, -3.25, -1.46,   .21,  1.67,  3.58,  6.07,  9.55, 13.03,
& -5.09, -3.27, -1.50,   .16,  1.66,  3.73,  6.38,  9.95, 13.52,
& -5.12, -3.30, -1.53,   .13,  1.75,  3.91,  6.71, 10.35, 13.98/
 DATA((ALP106(J,N),N=1,9),J=14,26)/
& -5.27, -3.28, -1.42,   .21,  1.91,  4.11,  7.05, 10.79, 14.52,
& -5.32, -3.08, -1.19,   .41,  2.09,  4.30,  7.35, 11.16, 14.97,
& -5.05, -2.84, -1.00,   .61,  2.25,  4.47,  7.61, 11.50, 15.38,
& -4.84, -2.74,  -.95,   .64,  2.25,  4.47,  7.49, 11.00, 14.51,
& -4.89, -2.89, -1.08,   .53,  2.08,  4.25,  7.21, 10.72, 14.23,
& -4.97, -3.05, -1.26,   .36,  1.89,  3.96,  6.85, 10.27, 13.69,
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& -5.03, -3.19, -1.42,   .22,  1.73,  3.74,  6.53,  9.98, 13.43,
& -5.08, -3.27, -1.47,   .24,  1.72,  3.77,  6.54, 10.05, 13.56,
& -5.11, -3.23, -1.38,   .34,  1.84,  3.97,  6.93, 10.21, 13.49,
& -5.10, -3.14, -1.26,   .45,  2.05,  4.41,  7.41, 10.61, 13.81,
& -4.91, -2.80,  -.73,  1.38,  4.03,  7.03,  9.93, 12.83, 15.72,
& -4.84, -2.71,  -.27,  2.69,  5.92,  8.98, 12.03, 15.08, 18.14,
& -4.99, -2.76,  -.04,  3.61,  7.27, 10.94, 14.61, 18.28, 21.94/
 DATA((ALP109(J,N),N=1,9),J=1,13)/
& -5.30, -3.26, -1.13,  1.02,  3.22,  5.56,  8.61, 11.84, 15.06,
& -5.00, -3.12, -1.10,   .91,  2.92,  5.19,  7.75, 10.51, 13.27,
& -4.83, -2.98, -1.03,   .86,  2.71,  4.86,  7.15,  9.65, 12.15,
& -4.71, -2.89, -1.00,   .83,  2.63,  4.63,  6.74,  9.12, 11.50,
& -4.57, -2.79,  -.98,   .76,  2.48,  4.38,  6.20,  8.61, 11.02,
& -4.50, -2.73,  -.96,   .73,  2.39,  4.24,  5.90,  8.76, 11.71,
& -4.42, -2.67,  -.95,   .69,  2.32,  4.13,  5.88,  9.23, 12.71,
& -4.35, -2.61,  -.95,   .65,  2.25,  4.02,  6.00, 10.08, 14.16,
& -4.26, -2.54,  -.93,   .62,  2.19,  3.96,  6.53, 10.98, 15.42,
& -4.18, -2.47,  -.92,   .58,  2.15,  4.09,  7.36, 11.95, 16.55,
& -4.11, -2.40,  -.91,   .56,  2.15,  4.57,  8.29, 13.05, 17.81,
& -4.05, -2.33,  -.89,   .56,  2.30,  5.06,  9.24, 14.12, 19.00,
& -3.98, -2.26,  -.82,   .74,  2.81,  5.61, 10.22, 15.10, 19.98/
 DATA((ALP109(J,N),N=1,9),J=14,26)/
& -3.92, -2.17,  -.66,  1.06,  3.29,  6.37, 10.97, 15.56, 20.16,
& -3.81, -2.10,  -.51,  1.34,  3.63,  6.85, 11.55, 16.26, 20.96,
& -3.80, -2.18,  -.57,  1.22,  3.43,  6.30, 11.30, 16.30, 21.30,
& -4.14, -2.44,  -.75,  1.00,  3.08,  5.77, 10.72, 15.85, 20.97,
& -4.45, -2.68,  -.93,   .81,  2.75,  5.36, 10.13, 15.47, 20.80,
& -4.65, -2.84, -1.05,   .67,  2.48,  5.04,  9.41, 14.54, 19.67,
& -4.72, -2.86, -1.05,   .69,  2.57,  5.20,  9.72, 14.85, 19.97,
& -4.72, -2.85, -1.00,   .79,  2.76,  5.48, 10.02, 14.90, 19.78,
& -4.70, -2.83,  -.95,   .89,  2.96,  5.76, 10.33, 15.04, 19.74,
& -4.68, -2.81,  -.89,  1.00,  3.18,  6.09, 10.53, 14.98, 19.42,
& -4.61, -2.71,  -.51,  1.73,  4.58,  8.08, 11.96, 15.84, 19.73,
& -4.58, -2.62,  -.21,  2.68,  5.79,  9.61, 13.50, 17.38, 21.26,
& -4.62, -2.61,  -.11,  3.49,  7.04, 10.88, 14.73, 18.58, 22.42/
 DATA((ALP112(J,N),N=1,9),J=1,13)/
& -5.31, -3.20,  -.99,  1.17,  3.70,  6.34,  9.95, 13.55, 17.15,
& -5.40, -3.18,  -.99,  1.10,  3.44,  5.90,  9.69, 13.54, 17.38,
& -5.45, -3.19, -1.02,  1.02,  3.21,  5.54,  8.94, 12.61, 16.28,
& -5.40, -3.18, -1.04,   .98,  3.10,  5.32,  8.38, 11.86, 15.34,
& -5.36, -3.17, -1.06,   .93,  2.96,  5.02,  7.53, 10.58, 13.63,
& -5.34, -3.16, -1.06,   .90,  2.90,  4.89,  7.19, 10.13, 13.07,
& -5.32, -3.16, -1.07,   .88,  2.84,  4.79,  7.17, 10.71, 14.25,
& -5.31, -3.15, -1.08,   .84,  2.77,  4.81,  7.55, 11.29, 15.03,
& -5.30, -3.13, -1.09,   .79,  2.72,  4.95,  8.31, 12.15, 16.00,
& -5.29, -3.12, -1.10,   .80,  2.84,  5.50,  9.74, 14.13, 18.53,
& -5.29, -3.10, -1.02,  1.00,  3.19,  6.53, 11.59, 16.66, 21.72,
& -5.23, -2.91,  -.74,  1.40,  3.81,  8.15, 14.12, 20.09, 26.06,
& -4.71, -2.34,  -.33,  1.88,  4.65, 10.64, 18.64, 26.64, 34.64/
 DATA((ALP112(J,N),N=1,9),J=14,26)/
& -4.32, -1.97,  -.13,  2.23,  5.13, 10.95, 17.73, 24.51, 31.29,
& -4.43, -2.16,  -.26,  1.95,  4.81, 11.17, 19.87, 28.57, 37.26,
& -5.14, -2.72,  -.56,  1.57,  4.27,  9.31, 17.00, 24.69, 32.38,
& -4.98, -3.00,  -.91,  1.21,  3.72,  7.73, 15.57, 23.41, 31.25,
& -4.93, -3.01, -1.05,   .99,  3.45,  7.00, 13.90, 20.79, 27.69,
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     & -4.91, -2.99,  -.98,  1.10,  3.59,  7.41, 13.97, 20.52, 27.08,
     & -4.88, -2.97,  -.91,  1.24,  3.79,  7.78, 13.94, 20.09, 26.25,
     & -4.87, -2.94,  -.83,  1.37,  4.02,  8.08, 13.72, 19.35, 24.99,
     & -4.84, -2.91,  -.75,  1.52,  4.27,  8.37, 13.63, 18.89, 24.16,
     & -4.83, -2.88,  -.65,  1.67,  4.52,  8.62, 13.56, 18.49, 23.43,
     & -4.64, -2.70,  -.18,  2.54,  5.75,  9.89, 14.11, 18.32, 22.53,
     & -4.50, -2.55,   .15,  3.22,  6.83, 10.67, 14.52, 18.37, 22.21,
     & -4.37, -2.49,   .26,  3.88,  7.70, 11.66, 15.62, 19.58, 23.54/
      DATA((ALP115(J,N),N=1,9),J=1,13)/
     & -5.27, -3.06,  -.82,  1.34,  4.19,  7.50, 11.07, 14.64, 18.21,
     & -5.37, -2.99,  -.75,  1.33,  3.86,  7.02, 10.47, 13.91, 17.36,
     & -5.40, -2.90,  -.71,  1.26,  3.63,  6.53,  9.87, 13.20, 16.53,
     & -5.43, -2.85,  -.70,  1.22,  3.52,  6.18,  9.46, 12.74, 16.02,
     & -5.42, -2.81,  -.70,  1.16,  3.30,  5.83,  8.92, 12.05, 15.17,
     & -5.42, -2.79,  -.71,  1.12,  3.19,  5.64,  8.63, 11.68, 14.73,
     & -5.44, -2.77,  -.71,  1.09,  3.10,  5.45,  8.90, 12.64, 16.37,
     & -5.49, -2.73,  -.72,  1.04,  3.02,  5.40, 10.11, 15.51, 20.92,
     & -5.54, -2.69,  -.70,  1.03,  3.08,  5.94, 13.26, 20.67, 28.07,
     & -5.60, -2.64,  -.58,  1.24,  3.84,  9.02, 17.18, 25.35, 33.51,
     & -5.39, -2.47,  -.24,  1.87,  5.05, 13.07, 22.37, 31.67, 40.98,
     & -4.86, -1.83,   .22,  2.78,  7.23, 17.49, 27.74, 38.00, 48.26,
     & -4.25, -1.53,   .50,  3.17,  8.52, 17.22, 25.91, 34.61, 43.30/
      DATA((ALP115(J,N),N=1,9),J=14,26)/
     & -4.58, -1.74,   .25,  2.65,  7.36, 15.36, 23.36, 31.36, 39.36,
     & -5.46, -2.51,  -.21,  1.96,  5.65, 13.25, 21.10, 28.94, 36.78,
     & -5.52, -2.97,  -.63,  1.48,  4.62, 11.52, 19.52, 27.52, 35.52,
     & -5.54, -2.97,  -.72,  1.30,  4.14, 11.22, 19.91, 28.61, 37.30,
     & -5.56, -2.98,  -.70,  1.37,  4.38, 11.57, 20.09, 28.60, 37.11,
     & -5.56, -2.98,  -.67,  1.47,  4.63, 11.84, 20.00, 28.16, 36.33,
     & -5.54, -2.97,  -.64,  1.56,  4.90, 12.00, 19.69, 27.38, 35.08,
     & -5.52, -2.97,  -.61,  1.65,  5.18, 12.11, 19.38, 26.65, 33.93,
     & -5.49, -2.96,  -.57,  1.74,  5.42, 12.56, 19.96, 27.37, 34.78,
     & -5.49, -2.96,  -.54,  1.86,  5.65, 12.89, 20.30, 27.70, 35.11,
     & -5.44, -2.84,  -.32,  2.66,  7.30, 14.70, 22.11, 29.52, 36.93,
     & -5.40, -2.71,  -.10,  3.39,  8.71, 16.55, 24.39, 32.24, 40.08,
     & -5.35, -2.59,   .18,  3.92,  9.84, 18.00, 26.16, 34.33, 42.49/
      DATA((ALP118(J,N),N=1,9),J=1,13)/
     & -6.10, -3.26,  -.59,  1.79,  4.94,  9.17, 13.52, 17.87, 22.22,
     & -6.18, -3.17,  -.49,  1.72,  4.77,  8.61, 12.53, 16.45, 20.37,
     & -6.42, -3.08,  -.47,  1.64,  4.46,  8.02, 11.98, 15.94, 19.90,
     & -6.25, -2.92,  -.47,  1.59,  4.26,  7.47, 10.98, 14.49, 18.00,
     & -5.94, -2.71,  -.52,  1.52,  3.99,  6.78, 10.32, 13.86, 17.40,
     & -5.76, -2.61,  -.52,  1.48,  3.94,  6.78, 10.59, 14.40, 18.21,
     & -5.61, -2.51,  -.51,  1.51,  4.14,  7.58, 12.02, 16.47, 20.91,
     & -5.44, -2.24,  -.45,  1.70,  4.81,  9.31, 13.91, 18.51, 23.10,
     & -5.17, -1.96,  -.21,  2.22,  6.44, 11.56, 16.69, 21.82, 26.95,
     & -4.93, -1.77,   .31,  3.17,  9.30, 16.70, 24.11, 31.52, 38.93,
     & -4.69, -1.52,   .99,  4.57, 14.40, 25.83, 37.26, 48.69, 60.11,
     & -4.48, -1.36,  1.33,  4.83, 17.14, 31.43, 45.71, 60.00, 74.29,
     & -4.34, -1.64,   .93,  3.87, 16.17, 33.57, 50.96, 68.35, 85.74/
      DATA((ALP118(J,N),N=1,9),J=14,26)/
     & -4.73, -2.12,   .28,  2.83, 10.72, 26.72, 42.72, 58.72, 74.72,
     & -5.09, -2.61,  -.27,  1.90,  6.22, 21.04, 35.85, 50.67, 65.48,
     & -5.46, -2.83,  -.48,  1.66,  5.49, 16.65, 28.41, 40.18, 51.94,
     & -5.71, -2.91,  -.46,  1.74,  5.69, 16.80, 28.23, 39.66, 51.09,
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& -5.73, -2.92,  -.44,  1.81,  5.88, 17.53, 29.29, 41.06, 52.82,
& -5.69, -2.87,  -.40,  1.90,  6.23, 17.66, 29.09, 40.51, 51.94,
& -5.65, -2.83,  -.37,  1.99,  6.65, 18.41, 30.18, 41.94, 53.71,
& -5.61, -2.79,  -.34,  2.12,  7.09, 18.51, 29.94, 41.37, 52.80,
& -5.56, -2.75,  -.31,  2.25,  7.44, 18.56, 29.67, 40.78, 51.89,
& -5.57, -2.74,  -.28,  2.37,  7.83, 18.94, 30.06, 41.17, 52.28,
& -5.51, -2.69,  -.11,  2.91, 10.00, 20.81, 31.62, 42.43, 53.24,
& -5.42, -2.68,   .10,  3.51, 12.18, 23.94, 35.71, 47.47, 59.24,
& -5.45, -2.61,   .23,  3.94, 13.76, 25.88, 38.00, 50.12, 62.24/
 DATA((ALP121(J,N),N=1,9),J=1,13)/
& -4.06, -2.24,  -.20,  2.29,  6.42, 12.48, 18.55, 24.61, 30.67,
& -4.08, -2.24,  -.20,  2.29,  6.33, 10.98, 15.63, 20.28, 24.93,
& -4.09, -2.27,  -.21,  2.19,  6.04,  9.92, 13.81, 17.69, 21.57,
& -4.17, -2.31,  -.27,  2.06,  5.76,  9.00, 12.23, 15.45, 18.68,
& -4.23, -2.43,  -.35,  1.88,  5.20,  8.91, 12.80, 16.68, 20.56,
& -4.26, -2.49,  -.34,  1.89,  5.32, 10.07, 15.01, 19.95, 24.89,
& -4.31, -2.57,  -.20,  2.28,  6.07, 12.97, 19.86, 26.76, 33.66,
& -4.21, -2.44,   .21,  3.23,  8.47, 14.35, 20.24, 26.12, 32.00,
& -4.09, -2.20,   .74,  4.90, 12.26, 19.81, 27.36, 34.91, 42.45,
& -3.82, -1.84,  1.43,  7.76, 19.88, 32.00, 44.12, 56.24, 68.36,
& -3.66, -1.79,  1.86,  9.90, 28.95, 48.00, 67.05, 86.10,105.14,
& -3.83, -2.10,  1.31,  7.50, 27.50, 47.50, 67.50, 87.50,107.50,
& -4.24, -2.56,  -.09,  3.85, 16.52, 31.33, 46.15, 60.96, 75.78/
 DATA((ALP121(J,N),N=1,9),J=14,26)/
& -4.84, -3.07, -1.09,  2.16, 13.88, 37.41, 60.94, 84.47,108.00,
& -5.41, -3.50, -1.49,  1.58,  8.96, 26.35, 43.74, 61.13, 78.52,
& -5.34, -3.50, -1.54,  1.66,  8.47, 21.80, 35.13, 48.47, 61.80,
& -5.29, -3.46, -1.50,  1.80,  9.04, 23.85, 38.67, 53.48, 68.30,
& -5.24, -3.40, -1.40,  1.96,  9.38, 23.17, 36.97, 50.76, 64.55,
& -5.20, -3.34, -1.31,  2.09,  9.80, 23.13, 36.47, 49.80, 63.13,
& -5.15, -3.28, -1.22,  2.25, 10.19, 23.10, 36.00, 48.90, 61.81,
& -5.11, -3.21, -1.13,  2.40, 10.50, 23.00, 35.50, 48.00, 60.50,
& -5.06, -3.15, -1.04,  2.57, 10.85, 22.97, 35.09, 47.21, 59.33,
& -5.01, -3.08,  -.95,  2.75, 11.18, 22.94, 34.71, 46.47, 58.24,
& -5.07, -2.82,  -.53,  3.70, 14.19, 26.69, 39.19, 51.69, 64.19,
& -4.96, -2.61,  -.24,  4.71, 16.44, 28.94, 41.44, 53.94, 66.44,
& -4.81, -2.55,  -.03,  5.78, 19.00, 32.33, 45.67, 59.00, 72.33/
 DATA((CD104(I,J),J=1,26),I=1,5)/
1 .0049, .0050, .0050, .0050, .0050, .0050, .0050, .0050, .0050,
1 .0050, .0051, .0051, .0054, .0073, .0146, .0185, .0224, .0256,
1 .0274, .0285, .0285, .0282, .0275, .0224, .0174, .0149,
2 .0049, .0050, .0050, .0050, .0050, .0050, .0050, .0050, .0050,
2 .0050, .0050, .0053, .0067, .0114, .0161, .0190, .0216, .0236,
2 .0252, .0268, .0275, .0280, .0285, .0291, .0275, .0245,
3 .0079, .0075, .0073, .0072, .0072, .0072, .0072, .0072, .0072,
3 .0072, .0073, .0082, .0108, .0169, .0236, .0274, .0301, .0325,
3 .0341, .0356, .0370, .0380, .0390, .0458, .0523, .0585,
4 .0334, .0247, .0199, .0181, .0173, .0172, .0176, .0185, .0211,
4 .0239, .0266, .0309, .0364, .0418, .0475, .0534, .0592, .0651,
4 .0700, .0749, .0798, .0841, .0874, .1019, .1114, .1176,
5 .0569, .0409, .0335, .0306, .0297, .0296, .0302, .0313, .0335,
5 .0401, .0486, .0571, .0669, .0780, .0891, .1002, .1114, .1226,
5 .1306, .1385, .1465, .1526, .1568, .1807, .1979, .2068/
 DATA((CD106(I,J),J=1,26),I=1,5)/
1 .0053, .0053, .0053, .0053, .0053, .0053, .0053, .0053, .0053,
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1 .0055, .0059, .0071, .0094, .0149, .0210, .0269, .0318, .0346,
1 .0355, .0360, .0363, .0363, .0363, .0320, .0282, .0247,
2 .0052, .0053, .0053, .0053, .0053, .0053, .0053, .0053, .0053,
2 .0055, .0060, .0071, .0104, .0163, .0228, .0285, .0327, .0354,
2 .0367, .0380, .0387, .0395, .0399, .0401, .0374, .0343,
3 .0088, .0076, .0075, .0075, .0075, .0075, .0075, .0075, .0075,
3 .0077, .0085, .0104, .0148, .0216, .0283, .0344, .0380, .0410,
3 .0431, .0447, .0463, .0478, .0492, .0573, .0640, .0700,
4 .0282, .0185, .0146, .0128, .0120, .0118, .0122, .0126, .0140,
4 .0169, .0244, .0318, .0392, .0467, .0541, .0627, .0734, .0813,
4 .0871, .0911, .0950, .0989, .1019, .1155, .1226, .1287,
5 .0514, .0370, .0303, .0294, .0290, .0295, .0302, .0324, .0367,
5 .0432, .0545, .0676, .0806, .0968, .1136, .1304, .1415, .1523,
5 .1606, .1668, .1730, .1790, .1842, .2094, .2270, .2449/
 DATA((CD109(I,J),J=1,26),I=1,5)/
1 .0055, .0055, .0055, .0056, .0057, .0058, .0060, .0062, .0064,
1 .0066, .0071, .0081, .0147, .0220, .0286, .0348, .0400, .0434,
1 .0466, .0489, .0512, .0532, .0535, .0539, .0491, .0433,
2 .0061, .0060, .0060, .0060, .0060, .0061, .0063, .0065, .0066,
2 .0070, .0075, .0084, .0155, .0233, .0301, .0364, .0418, .0451,
2 .0482, .0501, .0521, .0538, .0543, .0546, .0527, .0485,
3 .0091, .0089, .0088, .0088, .0088, .0087, .0087, .0089, .0090,
3 .0098, .0118, .0185, .0260, .0342, .0424, .0501, .0538, .0576,
3 .0601, .0627, .0652, .0663, .0674, .0717, .0765, .0788,
4 .0200, .0164, .0146, .0141, .0141, .0147, .0153, .0166, .0188,
4 .0245, .0301, .0365, .0482, .0599, .0714, .0821, .0922, .0985,
4 .1047, .1098, .1149, .1198, .1226, .1307, .1322, .1336,
5 .0384, .0305, .0264, .0249, .0242, .0246, .0260, .0292, .0390,
5 .0489, .0590, .0723, .0856, .0988, .1107, .1226, .1345, .1464,
5 .1533, .1595, .1657, .1719, .1775, .1927, .1987, .1934/
 DATA((CD112(I,J),J=1,26),I=1,5)/
1 .0060, .0060, .0060, .0060, .0060, .0060, .0060, .0060, .0060,
1 .0067, .0081, .0143, .0255, .0368, .0481, .0564, .0642, .0694,
1 .0745, .0765, .0786, .0798, .0802, .0814, .0784, .0704,
2 .0072, .0072, .0071, .0071, .0071, .0071, .0071, .0071, .0074,
2 .0081, .0104, .0168, .0268, .0366, .0448, .0521, .0591, .0649,
2 .0695, .0741, .0777, .0797, .0817, .0851, .0839, .0777,
3 .0110, .0111, .0112, .0112, .0113, .0113, .0115, .0120, .0128,
3 .0147, .0220, .0301, .0389, .0475, .0559, .0630, .0695, .0756,
3 .0803, .0851, .0896, .0926, .0957, .1074, .1090, .1102,
4 .0200, .0198, .0197, .0196, .0196, .0196, .0198, .0204, .0243,
4 .0366, .0489, .0616, .0747, .0862, .0977, .1080, .1157, .1234,
4 .1312, .1361, .1398, .1436, .1473, .1597, .1648, .1671,
5 .0324, .0302, .0283, .0283, .0290, .0297, .0318, .0374, .0535,
5 .0712, .0887, .1062, .1225, .1380, .1536, .1688, .1820, .1952,
5 .2084, .2215, .2294, .2373, .2452, .2679, .2759, .2868/
 DATA((CD115(I,J),J=1,26),I=1,5)/
1 .0070, .0070, .0070, .0070, .0070, .0070, .0070, .0070, .0076,
1 .0142, .0242, .0364, .0482, .0595, .0704, .0812, .0920, .1005,
1 .1082, .1158, .1200, .1240, .1252, .1225, .1123, .1023,
2 .0083, .0082, .0081, .0081, .0081, .0082, .0084, .0094, .0114,
2 .0195, .0309, .0412, .0520, .0624, .0723, .0808, .0892, .0974,
2 .1049, .1116, .1168, .1220, .1247, .1259, .1169, .1058,
3 .0153, .0154, .0154, .0153, .0153, .0153, .0154, .0164, .0206,
3 .0295, .0399, .0508, .0610, .0706, .0803, .0900, .0993, .1076,
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3 .1158, .1208, .1257, .1300, .1332, .1380, .1329, .1258,
4 .0220, .0238, .0247, .0251, .0255, .0258, .0274, .0340, .0457,
4 .0579, .0703, .0826, .0949, .1070, .1187, .1288, .1373, .1456,
4 .1533, .1610, .1673, .1713, .1752, .1827, .1785, .1711,
5 .0328, .0334, .0343, .0349, .0362, .0385, .0469, .0603, .0760,
5 .0934, .1108, .1281, .1459, .1638, .1800, .1949, .2098, .2219,
5 .2324, .2429, .2501, .2553, .2604, .2716, .2743, .2771/
 DATA((CD118(I,J),J=1,26),I=1,5)/
1 .0084, .0094, .0099, .0101, .0104, .0105, .0108, .0129, .0202,
1 .0317, .0432, .0542, .0646, .0751, .0848, .0942, .1035, .1129,
1 .1195, .1240, .1284, .1328, .1373, .1443, .1451, .1451,
2 .0085, .0099, .0107, .0111, .0114, .0116, .0120, .0151, .0255,
2 .0358, .0468, .0591, .0712, .0818, .0923, .1023, .1112, .1202,
2 .1292, .1333, .1371, .1410, .1449, .1506, .1512, .1518,
3 .0165, .0192, .0206, .0213, .0219, .0223, .0231, .0257, .0364,
3 .0488, .0610, .0733, .0855, .0959, .1053, .1146, .1240, .1309,
3 .1368, .1427, .1486, .1545, .1605, .1679, .1700, .1700,
4 .0264, .0341, .0380, .0399, .0419, .0430, .0450, .0579, .0715,
4 .0856, .0998, .1139, .1281, .1399, .1507, .1615, .1713, .1791,
4 .1862, .1930, .1976, .2022, .2068, .2171, .2198, .2182,
5 .0396, .0511, .0568, .0597, .0625, .0640, .0679, .0857, .1084,
5 .1308, .1527, .1746, .1964, .2183, .2365, .2515, .2665, .2815,
5 .2965, .3050, .3085, .3120, .3155, .3206, .3244, .3282/
 DATA((CD121(I,J),J=1,26),I=1,5)/
1 .0092, .0107, .0114, .0118, .0123, .0129, .0138, .0164, .0256,
1 .0372, .0500, .0634, .0756, .0882, .1010, .1138, .1246, .1351,
1 .1455, .1530, .1605, .1680, .1717, .1780, .1780, .1780,
2 .0109, .0125, .0133, .0137, .0141, .0146, .0156, .0199, .0295,
2 .0427, .0555, .0681, .0808, .0938, .1069, .1194, .1314, .1434,
2 .1525, .1605, .1685, .1750, .1782, .1842, .1842, .1842,
3 .0211, .0234, .0246, .0252, .0257, .0263, .0282, .0355, .0496,
3 .0626, .0761, .0897, .1027, .1156, .1285, .1401, .1515, .1628,
3 .1715, .1778, .1842, .1905, .1950, .2029, .2047, .2064,
4 .0433, .0485, .0511, .0528, .0560, .0592, .0658, .0777, .0939,
4 .1088, .1225, .1362, .1500, .1639, .1778, .1898, .2001, .2105,
4 .2195, .2269, .2343, .2410, .2461, .2581, .2557, .2533,
5 .0661, .0696, .0714, .0722, .0807, .0988, .1165, .1337, .1508,
5 .1684, .1863, .2041, .2219, .2389, .2554, .2719, .2884, .2982,
5 .3047, .3112, .3177, .3218, .3256, .3390, .3340, .3291/
 DATA(XMI(J),J=1,26)/.3,.5,.6,.65,.7,.725,.75,.775,
& .8,.825,.85,.875,.9,.925,.95,.975,1.0,1.025,1.05,1.075,
&1.1,1.125,1.15,1.3,1.45,1.6/
 DATA(CLI(J),J=1,9)/-.4,-.2,0.0,.2,.4,.6,.8,1.0,1.2/
 DATA(ALPI(J),J=1,7)/-4.0,-2.0,0.0,2.0,4.0,6.0,8.0/
 DATA(CLII(J),J=1,5)/0.0,.2,.4,.6,.8/
 IORDER(1)=IORDER(2)=1
 IPT (1) = -1
 IF (IKEY .EQ. 2) GO TO 1000
 IF (TR .LT. .04) GO TO 9
 IF (TR .GE. .04 .AND. TR .LT. .06) GO TO 1
 IF (TR .GE. .06 .AND. TR .LT. .09) GO TO 2
 IF (TR .GE. .09 .AND. TR .LT. .12) GO TO 3
 IF (TR .GE. .12 .AND. TR .LT. .15) GO TO 4
 IF (TR .GE. .15 .AND. TR .LT. .18) GO TO 5
 IF (TR .GE. .18 .AND. TR .LT. .21) GO TO 6
```

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      IF (TR .GE. .21) GO TO 7
    9 CALL IBI (7,ALPI,26,XMI,7,CL104,IORDER,IPT,AA,XM,CLFT04,IERR)
      CL=CLFT04
      GO TO 400
    1 CALL IBI (7,ALPI,26,XMI,7,CL104,IORDER,IPT,AA,XM,CLFT04,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL106,IORDER,IPT,AA,XM,CLFT06,IERR)
      CL=CLFT04 + (CLFT06-CLFT04)*((TR-.04)/(.06-.04))
      GO TO 400
    2 CALL IBI (7,ALPI,26,XMI,7,CL106,IORDER,IPT,AA,XM,CLFT06,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL109,IORDER,IPT,AA,XM,CLFT09,IERR)
      CL=CLFT06 + (CLFT09 - CLFT06)*((TR-.06)/(.09-.06))
      GO TO 400
    3 CALL IBI (7,ALPI,26,XMI,7,CL109,IORDER,IPT,AA,XM,CLFT09,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL112,IORDER,IPT,AA,XM,CLFT12,IERR)
      CL=CLFT09+(CLFT12-CLFT09)*((TR-.09)/(.12-.09))
      GO TO 400
    4 CALL IBI (7,ALPI,26,XMI,7,CL112,IORDER,IPT,AA,XM,CLFT12,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL115,IORDER,IPT,AA,XM,CLFT15,IERR)
      CL=CLFT12 + (CLFT15-CLFT12)*((TR-.12)/(.15-.12))
      GO TO 400
    5 CALL IBI (7,ALPI,26,XMI,7,CL115,IORDER,IPT,AA,XM,CLFT15,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL118,IORDER,IPT,AA,XM,CLFT18,IERR)
      CL=CLFT15+(CLFT18-CLFT15)*((TR-.15)/(.18-.15))
      GO TO 400
    6 CALL IBI (7,ALPI,26,XMI,7,CL118,IORDER,IPT,AA,XM,CLFT18,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL121,IORDER,IPT,AA,XM,CLFT21,IERR)
      CL=CLFT18+(CLFT21-CLFT18)*((TR-.18)/(.21-.18))
      GO TO 400
    7 CALL IBI (7,ALPI,26,XMI,7,CL121,IORDER,IPT,AA,XM,CLFT21,IERR)
      CL=CLFT21
      GO TO 400
 1000 CONTINUE
      IPT (1)=-1
      IF (TR .LT. .04) GO TO 90
      IF (TR .GE. .04 .AND. TR .LT. .06) GO TO 10
      IF (TR .GE. .06 .AND. TR .LT. .09) GO TO 20
      IF (TR .GE. .09 .AND. TR .LT. .12) GO TO 30
      IF (TR .GE. .12 .AND. TR .LT. .15) GO TO 40
      IF (TR .GE. .15 .AND. TR .LT. .18) GO TO 50
      IF (TR .GE. .18 .AND. TR .LT. .21) GO TO 60
      IF (TR .GE. .21) GO TO 70
   90 CALL IBI (26,XMI,9,CLI,26,ALP104,IORDER,IPT,XM,CL,AA04,IERR)
      AA=AA04
      GO TO 400
   10 CALL IBI (26,XMI,9,CLI,26,ALP104,IORDER,IPT,XM,CL,AA04,IERR)
      IPT (1) = -1
      CALL IBI (26,XMI,9,CLI,26,ALP106,IORDER,IPT,XM,CL,AA06,IERR)
      AA=AA04 + (AA06-AA04)*((TR-.04)/(.06-.04))
      GO TO 400
```

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 20   CALL IBI (26,XMI,9,CLI,26,ALP106,IORDER,IPT,XM,CL,AA06,IERR)
      IPT (1) = -1
      CALL IBI (26,XMI,9,CLI,26,ALP109,IORDER,IPT,XM,CL,AA09,IERR)
      AA=AA06 + (AA09 - AA06)*((TR -.06)/(.09-.06))
      GO TO 400
 30   CALL IBI (26,XMI,9,CLI,26,ALP109,IORDER,IPT,XM,CL,AA09,IERR)
      IPT (1) = -1
      CALL IBI (26,XMI,9,CLI,26,ALP112,IORDER,IPT,XM,CL,AA12,IERR)
      AA=AA09+(AA12-AA09)*((TR-.09)/(.12-.09))
      GO TO 400
 40   CALL IBI (26,XMI,9,CLI,26,ALP112,IORDER,IPT,XM,CL,AA12,IERR)
      IPT (1) = -1
      CALL IBI (26,XMI,9,CLI,26,ALP115,IORDER,IPT,XM,CL,AA15,IERR)
      AA=AA12+(AA15-AA12)*((TR-.12)/(.15-.12))
      GO TO 400
 50   CALL IBI (26,XMI,9,CLI,26,ALP115,IORDER,IPT,XM,CL,AA15,IERR)
      IPT (1) = -1
      CALL IBI (26,XMI,9,CLI,26,ALP118,IORDER,IPT,XM,CL,AA18,IERR)
      AA=AA15+(AA18-AA15)*((TR-.15)/(.18-.15))
 60   CALL IBI (26,XMI,9,CLI,26,ALP118,IORDER,IPT,XM,CL,AA18,IERR)
      IPT (1) = -1
      CALL IBI (26,XMI,9,CLI,26,ALP121,IORDER,IPT,XM,CL,AA21,IERR)
      AA=AA18+(AA21-AA18)*((TR-.18)/(.21-.18))
      GO TO 400
 70   CALL IBI (26,XMI,9,CLI,26,ALP121,IORDER,IPT,XM,CL,AA21,IERR)
      AA=AA21
400   CONTINUE
      IPT (1)=-1
      IF (TR .LT. .04) GO TO 91
      IF (TR .GE. .04 .AND. TR .LT. .06) GO TO 11
      IF (TR .GE. .06 .AND. TR .LT. .09) GO TO 21
      IF (TR .GE. .09 .AND. TR .LT. .12) GO TO 31
      IF (TR .GE. .12 .AND. TR .LT. .15) GO TO 41
      IF (TR .GE. .15 .AND. TR .LT. .18) GO TO 51
      IF (TR .GE. .18 .AND. TR .LT. .21) GO TO 61
      IF (TR .GE. .21) GO TO 71
 91   CALL IBI (5,CLII,26,XMI,5,CD104,IORDER,IPT,CL,XM,CDRG04,IERR)
      CD=CDRG04
      WRITE (6,201) TR
201   FORMAT(*0THICKNESS RATIO=*,F5.3,* IS OUT OF RANGE.
     &*/* THE VALUES FOR T/C=.04 HAVE BEEN RETURNED*)
      GO TO 250
 11   CALL IBI (5,CLII,26,XMI,5,CD104,IORDER,IPT,CL,XM,CDRG04,IERR)
      IPT (1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD106,IORDER,IPT,CL,XM,CDRG06,IERR)
      CD=CDRG04 + (CDRG06-CDRG04)*((TR-.04)/(.06-.04))
      GO TO 250
 21   CALL IBI (5,CLII,26,XMI,5,CD106,IORDER,IPT,CL,XM,CDRG06,IERR)
      IPT (1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD109,IORDER,IPT,CL,XM,CDRG09,IERR)
      CD=CDRG06 + (CDRG09 - CDRG06)*((TR-.06)/(.09-.06))
      GO TO 250
 31   CALL IBI (5,CLII,26,XMI,5,CD109,IORDER,IPT,CL,XM,CDRG09,IERR)
      IPT (1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD112,IORDER,IPT,CL,XM,CDRG12,IERR)
```

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      CD=CDRG09+(CDRG12-CDRG09)*((TR-.09)/(.12-.09))
      GO TO 250
   41 CALL IBI (5,CLII,26,XMI,5,CD112,IORDER,IPT,CL,XM,CDRG12,IERR)
      IPT (1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD115,IORDER,IPT,CL,XM,CDRG15,IERR)
      CD=CDRG12 + (CDRG15-CDRG12)*((TR-.12)/(.15-.12))
      GO TO 250
   51 CALL IBI (5,CLII,26,XMI,5,CD115,IORDER,IPT,CL,XM,CDRG15,IERR)
      IPT (1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD118,IORDER,IPT,CL,XM,CDRG18,IERR)
      CD=CDRG15+(CDRG18-CDRG15)*((TR-.15)/(.18-.15))
      GO TO 250
   61 CALL IBI (5,CLII,26,XMI,5,CD118,IORDER,IPT,CL,XM,CDRG18,IERR)
      IPT (1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD121,IORDER,IPT,CL,XM,CDRG21,IERR)
      CD=CDRG18+(CDRG21-CDRG18)*((TR-.18)/(.21-.18))
      GO TO 250
   71 CALL IBI (5,CLII,26,XMI,5,CD121,IORDER,IPT,CL,XM,CDRG21,IERR)
      CD=CDRG21
      IF (TR .GT. .21) WRITE(6,204) TR
  204  FORMAT(*0THICKNESS RATIO=*,F5.3,* IS OUT OF RANGE.
     &*/* THE VALUES FOR T/C=.21 HAVE BEEN RETURNED.*)
  250 IF(CL .GT. .8) GO TO 251
      RETURN
  251  CALL COMPUT(D,XM,ALT,COR,TR,AA,CDT,CL,CD,CLDES)
      CD=CDT
      RETURN
      END


      SUBROUTINE AERO2(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
C
C
C THIS SUBROUTINE IS DESIGNED TO COMPUTE THE AIRFOIL
C CHARACTERISTICS FOR A 16 SERIES AIRFOIL WITH A GIVEN CAMBER.
C
C THIS SUBROUTINE RELATES CL,CD,CL/CD,MACH,T/C,AND ALPHA.
C IT REPRESENTS THE DATA OF A 16-2XX AIRFOIL.
C
C XM=RELATIVE MACH NO. AT BLADE ELEMENT
C AA=ANGLE OF ATTACK IN DEGREES
C IKEY1: CL=CL(MACH,ALPHA,T/C)
C      : CD=CD(MACH,CL,T/C)
C      :XLD=CL/CD
C IKEY2: ALPHA=ALPHA(MACH,CL,T/C)
C      : CD=CD(MACH,CL,T/C)
C      :XLD=CL/CD
C TR=T/C
C
C
C
C
      DIMENSION IORDER(2),IPT(2),ALP204(26,9),ALP206(26,9),
     & ALP209(26,9),ALP212(26,9),ALP215(26,9),ALP218(26,9),
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& ALP221(26,9),CLI(9),XMI(26),ALPI(7),CL204(7,26),
& CL206(7,26),CL209(7,26),CL212(7,26),CL215(7,26),
& CL218(7,26),CL221(7,26),CD204(5,26),CD206(5,26),
& CD209(5,26),CD212(5,26),CD215(5,26),CD218(5,26),
& CD221(5,26),CLII(5)
 DATA((CL204(I,J),J=1,26),I=1,4)/
1 -.232, -.237, -.238, -.237, -.235, -.234, -.234, -.233, -.232,
1 -.230, -.220, -.203, -.181, -.159, -.144, -.148, -.165, -.176,
1 -.171, -.165, -.160, -.157, -.162, -.256, -.262, -.262,
2 -.019, -.025, -.028, -.031, -.034, -.036, -.037, -.038, -.036,
2 -.032, -.019,  .005,  .029,  .054,  .066,  .056,  .036,  .021,
2  .027,  .035,  .043,  .047,  .036, -.124, -.151, -.153,
3  .188,  .196,  .213,  .224,  .236,  .242,  .250,  .257,  .265,
3  .273,  .281,  .291,  .302,  .310,  .309,  .281,  .255,  .236,
3  .247,  .265,  .285,  .289,  .277,  .098, -.006, -.015,
4  .412,  .427,  .450,  .462,  .479,  .488,  .497,  .507,  .516,
4  .526,  .538,  .550,  .553,  .545,  .529,  .512,  .494,  .489,
4  .499,  .517,  .533,  .540,  .508,  .286,  .137,  .106/
 DATA((CL204(I,J),J=1,26),I=5,7)/
5  .596,  .629,  .668,  .693,  .727,  .744,  .761,  .780,  .791,
5  .791,  .781,  .770,  .757,  .740,  .724,  .714,  .705,  .703,
5  .711,  .725,  .749,  .764,  .730,  .456,  .277,  .214,
6  .784,  .827,  .868,  .894,  .935,  .955,  .973,  .980,  .970,
6  .958,  .945,  .932,  .917,  .902,  .886,  .871,  .856,  .849,
6  .860,  .881,  .906,  .918,  .884,  .609,  .402,  .319,
7  .922,  .973, 1.040, 1.085, 1.111, 1.106, 1.099, 1.085, 1.071,
7 1.057, 1.043, 1.029, 1.014, 1.000,  .987,  .977,  .971,  .971,
7  .977,  .996, 1.022, 1.034,  .999,  .744,  .535,  .430/
 DATA((CL206(I,J),J=1,26),I=1,4)/
1 -.206, -.206, -.206, -.206, -.206, -.206, -.206, -.207, -.208,
1 -.209, -.209, -.211, -.212, -.222, -.258, -.303, -.333, -.307,
1 -.277, -.261, -.249, -.256, -.271, -.323, -.284, -.224,
2 -.015, -.021, -.024, -.025, -.023, -.023, -.022, -.023, -.023,
2 -.024, -.025, -.025, -.025, -.041, -.086, -.135, -.141, -.118,
2 -.094, -.075, -.069, -.082, -.097, -.157, -.136, -.114,
3  .172,  .183,  .200,  .209,  .219,  .224,  .229,  .234,  .239,
3  .249,  .258,  .268,  .266,  .237,  .199,  .164,  .160,  .181,
3  .206,  .226,  .227,  .211,  .191,  .069, -.015, -.025,
4  .376,  .403,  .427,  .447,  .467,  .478,  .489,  .500,  .512,
4  .523,  .535,  .523,  .496,  .462,  .427,  .406,  .406,  .424,
4  .448,  .472,  .474,  .448,  .414,  .220,  .115,  .096/
 DATA((CL206(I,J),J=1,26),I=5,7)/
5  .564,  .617,  .658,  .681,  .711,  .729,  .746,  .758,  .755,
5  .744,  .719,  .694,  .669,  .644,  .619,  .597,  .592,  .610,
5  .640,  .664,  .664,  .635,  .598,  .391,  .255,  .203,
6  .736,  .793,  .840,  .878,  .915,  .931,  .938,  .922,  .899,
6  .875,  .852,  .829,  .805,  .782,  .759,  .737,  .740,  .758,
6  .786,  .804,  .801,  .783,  .749,  .547,  .404,  .315,
7  .864,  .930,  .999, 1.035, 1.071, 1.074, 1.060, 1.041, 1.022,
7 1.003,  .979,  .954,  .929,  .904,  .879,  .854,  .847,  .865,
7  .896,  .920,  .917,  .892,  .862,  .685,  .528,  .430/
 DATA((CL209(I,J),J=1,26),I=1,4)/
1 -.174, -.183, -.183, -.183, -.193, -.199, -.206, -.217, -.229,
1 -.241, -.254, -.268, -.282, -.295, -.306, -.287, -.253, -.231,
1 -.214, -.220, -.226, -.232, -.236, -.258, -.264, -.264,
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2 -.012, -.012, -.012, -.012, -.018, -.022, -.027, -.032, -.037,
2 -.049, -.060, -.072, -.084, -.105, -.120, -.102, -.068, -.035,
2 -.021, -.024, -.038, -.049, -.061, -.107, -.132, -.141,
3  .153,  .159,  .169,  .174,  .183,  .188,  .194,  .202,  .210,
3  .218,  .221,  .201,  .154,  .107,  .060,  .064,  .099,  .140,
3  .162,  .157,  .142,  .124,  .107,  .010, -.025, -.025,
4  .351,  .379,  .403,  .416,  .434,  .442,  .451,  .465,  .478,
4  .474,  .450,  .394,  .339,  .283,  .255,  .269,  .301,  .337,
4  .356,  .342,  .318,  .293,  .269,  .156,  .109,  .092/
 DATA((CL209(I,J),J=1,26),I=5,7)/
5  .522,  .552,  .584,  .603,  .629,  .645,  .661,  .678,  .670,
5  .631,  .591,  .550,  .509,  .468,  .432,  .435,  .479,  .517,
5  .530,  .516,  .490,  .464,  .438,  .316,  .247,  .204,
6  .697,  .736,  .788,  .819,  .855,  .871,  .858,  .828,  .797,
6  .767,  .723,  .678,  .634,  .590,  .567,  .583,  .622,  .657,
6  .676,  .663,  .642,  .618,  .593,  .468,  .377,  .308,
7  .817,  .870,  .930,  .972, 1.007,  .992,  .968,  .935,  .902,
7  .860,  .817,  .775,  .732,  .684,  .653,  .660,  .698,  .737,
7  .758,  .748,  .730,  .710,  .689,  .585,  .498,  .420/
 DATA((CL212(I,J),J=1,26),I=1,4)/
1 -.207, -.203, -.201, -.198, -.195, -.194, -.192, -.192, -.197,
1 -.220, -.258, -.335, -.410, -.443, -.409, -.333, -.280, -.260,
1 -.270, -.280, -.289, -.298, -.306, -.342, -.359, -.364,
2 -.024, -.021, -.021, -.020, -.017, -.015, -.013, -.010, -.011,
2 -.023, -.052, -.123, -.202, -.239, -.212, -.171, -.130, -.098,
2 -.110, -.120, -.130, -.141, -.150, -.197, -.217, -.220,
3  .142,  .149,  .164,  .172,  .182,  .186,  .191,  .196,  .198,
3  .187,  .151,  .081,  .012, -.023,  .001,  .045,  .088,  .115,
3  .106,  .096,  .085,  .075,  .064,  .011, -.020, -.028,
4  .328,  .346,  .359,  .368,  .378,  .387,  .395,  .404,  .399,
4  .361,  .312,  .253,  .196,  .162,  .185,  .230,  .274,  .297,
4  .284,  .269,  .255,  .241,  .227,  .157,  .107,  .080/
 DATA((CL212(I,J),J=1,26),I=5,7)/
5  .476,  .505,  .527,  .540,  .561,  .571,  .584,  .599,  .571,
5  .507,  .444,  .381,  .323,  .302,  .337,  .385,  .429,  .442,
5  .430,  .415,  .401,  .386,  .372,  .292,  .233,  .185,
6  .613,  .653,  .700,  .726,  .758,  .780,  .779,  .739,  .682,
6  .626,  .570,  .514,  .460,  .443,  .476,  .517,  .556,  .573,
6  .562,  .547,  .531,  .515,  .500,  .417,  .349,  .301,
7  .743,  .791,  .839,  .871,  .910,  .903,  .852,  .795,  .738,
7  .680,  .623,  .566,  .514,  .499,  .533,  .578,  .622,  .639,
7  .629,  .619,  .608,  .598,  .588,  .525,  .474,  .424/
 DATA((CL215(I,J),J=1,26),I=1,4)/
1 -.212, -.217, -.227, -.231, -.239, -.243, -.247, -.253, -.284,
1 -.340, -.417, -.505, -.519, -.492, -.419, -.311, -.239, -.248,
1 -.249, -.250, -.251, -.253, -.254, -.260, -.265, -.270,
2 -.046, -.052, -.058, -.062, -.067, -.070, -.073, -.079, -.109,
2 -.166, -.234, -.297, -.321, -.301, -.238, -.118, -.073, -.078,
2 -.083, -.088, -.092, -.095, -.097, -.110, -.120, -.131,
3  .106,  .116,  .121,  .123,  .130,  .135,  .139,  .137,  .124,
3  .088,  .020, -.077, -.114, -.081, -.022,  .034,  .061,  .064,
3  .060,  .055,  .050,  .046,  .041,  .012, -.004, -.011,
4  .288,  .309,  .324,  .334,  .343,  .348,  .353,  .349,  .332,
4  .276,  .174,  .090,  .075,  .109,  .178,  .236,  .249,  .239,
4  .229,  .220,  .212,  .204,  .196,  .154,  .120,  .096/
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 DATA((CL215(I,J),J=1,26),I=5,7)/
5  .431,  .458,  .485,  .503,  .527,  .537,  .524,  .496,  .454,
5  .385,  .307,  .226,  .196,  .230,  .295,  .354,  .378,  .367,
5  .357,  .346,  .335,  .326,  .317,  .268,  .235,  .213,
6  .554,  .584,  .617,  .641,  .685,  .690,  .671,  .627,  .555,
6  .474,  .392,  .313,  .288,  .330,  .397,  .452,  .465,  .457,
6  .448,  .440,  .432,  .424,  .416,  .374,  .347,  .330,
7  .659,  .695,  .735,  .766,  .805,  .798,  .762,  .687,  .606,
7  .525,  .444,  .365,  .347,  .378,  .448,  .508,  .527,  .521,
7  .514,  .508,  .502,  .496,  .490,  .461,  .442,  .434/
 DATA((CL218(I,J),J=1,26),I=1,4)/
1 -.212, -.221, -.240, -.254, -.273, -.283, -.298, -.327, -.374,
1 -.421, -.463, -.490, -.473, -.410, -.339, -.286, -.274, -.273,
1 -.272, -.272, -.273, -.274, -.275, -.282, -.284, -.291,
2 -.058, -.058, -.065, -.072, -.080, -.087, -.101, -.150, -.203,
2 -.254, -.301, -.324, -.278, -.215, -.157, -.117, -.111, -.113,
2 -.114, -.115, -.117, -.118, -.119, -.129, -.137, -.137,
3  .093,  .104,  .112,  .116,  .122,  .125,  .115,  .046, -.022,
3 -.091, -.152, -.182, -.153, -.076,  .003,  .034,  .031,  .028,
3  .025,  .022,  .019,  .017,  .015,  .003, -.008, -.008,
4  .268,  .276,  .287,  .293,  .300,  .299,  .267,  .208,  .147,
4  .086,  .026, -.012,  .016,  .098,  .176,  .208,  .203,  .197,
4  .192,  .187,  .182,  .176,  .171,  .142,  .116,  .100/
 DATA((CL218(I,J),J=1,26),I=5,7)/
5  .413,  .425,  .437,  .445,  .457,  .452,  .408,  .346,  .284,
5  .222,  .160,  .115,  .142,  .229,  .305,  .328,  .321,  .315,
5  .308,  .302,  .296,  .289,  .282,  .244,  .214,  .192,
6  .504,  .537,  .565,  .588,  .623,  .598,  .524,  .450,  .375,
6  .301,  .238,  .203,  .227,  .310,  .382,  .415,  .406,  .398,
6  .390,  .381,  .373,  .366,  .359,  .319,  .288,  .259,
7  .600,  .639,  .683,  .713,  .738,  .685,  .612,  .525,  .438,
7  .351,  .273,  .232,  .255,  .338,  .418,  .449,  .441,  .432,
7  .424,  .415,  .407,  .399,  .392,  .350,  .314,  .281/
 DATA((CL221(I,J),J=1,26),I=1,4)/
1 -.266, -.263, -.253, -.239, -.226, -.226, -.234, -.256, -.312,
1 -.372, -.434, -.421, -.339, -.257, -.213, -.210, -.216, -.223,
1 -.230, -.237, -.243, -.249, -.255, -.263, -.268, -.275,
2 -.111, -.115, -.102, -.086, -.065, -.059, -.072, -.107, -.164,
2 -.239, -.291, -.277, -.203, -.129, -.071, -.076, -.084, -.092,
2 -.101, -.109, -.117, -.126, -.135, -.167, -.167, -.167,
3  .069,  .071,  .072,  .078,  .087,  .083,  .069,  .021, -.039,
3 -.124, -.176, -.154, -.054,  .051,  .084,  .078,  .070,  .062,
3  .054,  .046,  .039,  .031,  .025,  .000, -.006, -.007,
4  .239,  .226,  .233,  .246,  .250,  .237,  .196,  .125,  .054,
4 -.013, -.059, -.050,  .048,  .148,  .178,  .176,  .169,  .160,
4  .151,  .141,  .135,  .128,  .122,  .095,  .082,  .072/
 DATA((CL221(I,J),J=1,26),I=5,7)/
5  .370,  .364,  .374,  .383,  .387,  .379,  .344,  .277,  .185,
5  .101,  .044,  .061,  .151,  .257,  .287,  .286,  .277,  .269,
5  .260,  .252,  .243,  .235,  .228,  .190,  .168,  .157,
6  .420,  .433,  .471,  .498,  .511,  .479,  .417,  .337,  .243,
6  .144,  .115,  .137,  .230,  .323,  .357,  .354,  .344,  .332,
6  .321,  .314,  .306,  .299,  .292,  .256,  .240,  .223,
7  .495,  .533,  .586,  .625,  .622,  .574,  .482,  .385,  .287,
7  .190,  .144,  .159,  .255,  .358,  .385,  .381,  .373,  .366,
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7  .358,  .351,  .343,  .336,  .328,  .288,  .269,  .253/
 DATA((ALP204(J,N),N=1,9),J=1,13)/
& -5.58, -3.70, -1.82,   .11,  1.89,  4.04,  6.23,  9.13, 12.03,
& -5.54, -3.65, -1.77,   .03,  1.77,  3.71,  5.73,  8.37, 11.11,
& -5.54, -3.64, -1.77,  -.11,  1.58,  3.38,  5.32,  7.53,  9.86,
& -5.58, -3.64, -1.76,  -.19,  1.48,  3.19,  5.06,  7.11,  9.20,
& -5.64, -3.65, -1.75,  -.27,  1.35,  2.98,  4.70,  6.74,  9.01,
& -5.68, -3.66, -1.74,  -.30,  1.28,  2.88,  4.53,  6.60,  9.25,
& -5.69, -3.65, -1.74,  -.35,  1.21,  2.78,  4.37,  6.43,  9.60,
& -5.71, -3.66, -1.74,  -.39,  1.14,  2.68,  4.20,  6.38, 10.19,
& -5.71, -3.67, -1.76,  -.43,  1.08,  2.61,  4.10,  6.59, 10.55,
& -5.72, -3.70, -1.79,  -.48,  1.00,  2.56,  4.11,  6.85, 10.89,
& -5.79, -3.80, -1.87,  -.54,   .93,  2.51,  4.23,  7.12, 11.20,
& -5.89, -3.97, -2.05,  -.64,   .84,  2.45,  4.37,  7.40, 11.53,
& -6.09, -4.18, -2.28,  -.75,   .78,  2.46,  4.54,  7.71, 11.84/
 DATA((ALP204(J,N),N=1,9),J=14,26)/
& -6.26, -4.38, -2.51,  -.86,   .77,  2.56,  4.74,  8.00, 12.08,
& -6.44, -4.53, -2.63,  -.90,   .83,  2.73,  4.94,  8.26, 12.22,
& -6.47, -4.51, -2.55,  -.72,  1.03,  2.87,  5.10,  8.43, 12.21,
& -6.34, -4.35, -2.36,  -.50,  1.21,  3.00,  5.26,  8.50, 11.98,
& -6.27, -4.24, -2.21,  -.33,  1.30,  3.04,  5.33,  8.48, 11.75,
& -6.31, -4.29, -2.27,  -.43,  1.21,  2.95,  5.19,  8.39, 11.81,
& -6.35, -4.35, -2.35,  -.57,  1.07,  2.80,  4.96,  8.07, 11.55,
& -6.36, -4.39, -2.42,  -.70,   .93,  2.62,  4.65,  7.62, 11.07,
& -6.38, -4.42, -2.46,  -.74,   .88,  2.54,  4.47,  7.41, 10.86,
& -6.40, -4.38, -2.36,  -.64,  1.06,  2.83,  4.91,  8.02, 11.50,
& -6.18, -3.15,  -.88,  1.09,  3.34,  5.88,  8.83, 11.79, 14.76,
& -6.49, -2.88,   .08,  2.90,  5.97,  8.98, 11.98, 14.99, 18.00,
& -6.53, -2.86,   .25,  3.74,  7.46, 11.06, 14.67, 18.27, 21.87/
 DATA((ALP206(J,N),N=1,9),J=1,13)/
& -6.03, -3.94, -1.84,   .27,  2.26,  4.42,  7.00, 10.13, 13.25,
& -6.10, -3.94, -1.79,   .15,  1.97,  3.84,  6.10,  9.02, 11.94,
& -6.13, -3.93, -1.79,  0.00,  1.76,  3.50,  5.56,  8.01, 10.53,
& -6.14, -3.93, -1.79,  -.08,  1.61,  3.31,  5.21,  7.55, 10.10,
& -6.12, -3.93, -1.81,  -.16,  1.46,  3.09,  4.87,  7.09,  9.65,
& -6.12, -3.93, -1.81,  -.19,  1.39,  2.97,  4.70,  6.97,  9.76,
& -6.11, -3.93, -1.82,  -.23,  1.32,  2.86,  4.56,  7.02, 10.30,
& -6.10, -3.92, -1.82,  -.26,  1.25,  2.78,  4.51,  7.31, 10.67,
& -6.08, -3.91, -1.82,  -.30,  1.18,  2.72,  4.63,  7.64, 10.89,
& -6.06, -3.90, -1.82,  -.36,  1.10,  2.70,  4.85,  7.95, 11.08,
& -6.08, -3.90, -1.82,  -.41,  1.03,  2.71,  5.22,  8.33, 11.48,
& -6.03, -3.88, -1.83,  -.46,  1.04,  2.90,  5.57,  8.74, 11.94,
& -6.01, -3.87, -1.83,  -.45,  1.17,  3.20,  5.93,  9.15, 12.37/
 DATA((ALP206(J,N),N=1,9),J=14,26)/
& -5.97, -3.76, -1.71,  -.27,  1.45,  3.52,  6.30,  9.57, 12.85,
& -5.65, -3.33, -1.40,   .01,  1.76,  3.80,  6.68, 10.02, 13.35,
& -5.15, -2.77, -1.10,   .30,  1.95,  4.04,  7.08, 10.50, 13.91,
& -4.70, -2.61, -1.06,   .33,  1.95,  4.11,  7.12, 10.86, 14.60,
& -4.98, -2.87, -1.21,   .16,  1.80,  3.89,  6.79, 10.52, 14.26,
& -5.34, -3.16, -1.37,  -.04,  1.60,  3.58,  6.25,  9.89, 13.53,
& -5.49, -3.34, -1.50,  -.17,  1.41,  3.33,  5.94,  9.38, 12.83,
& -5.68, -3.46, -1.53,  -.18,  1.40,  3.33,  5.99,  9.43, 12.88,
& -5.66, -3.36, -1.44,  -.08,  1.59,  3.63,  6.31,  9.98, 13.65,
& -5.48, -3.18, -1.33,   .08,  1.87,  4.03,  6.90, 10.44, 13.98,
& -4.93, -2.52,  -.61,  1.74,  4.12,  6.77,  9.67, 12.57, 15.46,
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     & -5.57, -2.86,   .23,  3.21,  5.95,  9.16, 12.39, 15.61, 18.84,
     & -7.20, -3.56,   .41,  3.94,  7.48, 10.96, 14.43, 17.91, 21.39/
      DATA((ALP209(J,N),N=1,9),J=1,13)/
     & -6.79, -4.32, -1.85,   .47,  2.57,  4.89,  7.72, 11.05, 14.38,
     & -6.54, -4.20, -1.86,   .37,  2.24,  4.52,  6.96,  9.94, 12.93,
     & -6.54, -4.20, -1.87,   .26,  1.97,  4.16,  6.17,  8.99, 11.80,
     & -6.54, -4.20, -1.87,   .21,  1.87,  3.97,  5.82,  8.37, 10.98,
     & -6.37, -4.08, -1.82,   .14,  1.73,  3.70,  5.51,  7.91, 10.54,
     & -6.27, -4.01, -1.79,   .09,  1.67,  3.56,  5.37,  8.13, 11.44,
     & -6.17, -3.93, -1.76,   .05,  1.60,  3.42,  5.41,  8.58, 12.22,
     & -5.98, -3.82, -1.73,  -.02,  1.51,  3.27,  5.63,  9.21, 12.95,
     & -5.78, -3.70, -1.70,  -.08,  1.42,  3.27,  6.06,  9.87, 13.68,
     & -5.66, -3.57, -1.63,  -.13,  1.42,  3.61,  6.71, 11.01, 15.31,
     & -5.51, -3.44, -1.57,  -.15,  1.56,  4.14,  7.64, 11.89, 16.15,
     & -5.35, -3.31, -1.47,  -.01,  2.08,  4.78,  8.52, 12.64, 16.76,
     & -5.19, -3.17, -1.29,   .50,  2.72,  5.46,  9.39, 13.47, 17.55/
      DATA((ALP209(J,N),N=1,9),J=14,26)/
     & -5.11, -3.00, -1.01,  1.06,  3.26,  6.21, 10.47, 14.72, 18.98,
     & -5.01, -2.86,  -.67,  1.44,  3.64,  6.77, 11.42, 16.07, 20.72,
     & -5.22, -3.06,  -.77,  1.33,  3.58,  6.44, 11.64, 16.83, 22.03,
     & -5.59, -3.43, -1.19,  1.00,  3.11,  5.69, 10.68, 15.95, 21.21,
     & -5.72, -3.68, -1.60,   .61,  2.70,  5.19,  9.58, 14.58, 19.58,
     & -5.93, -3.85, -1.77,   .39,  2.51,  4.96,  9.02, 13.90, 18.78,
     & -5.84, -3.80, -1.73,   .46,  2.67,  5.14,  9.22, 13.93, 18.64,
     & -5.85, -3.72, -1.58,   .66,  2.95,  5.45,  9.59, 14.14, 18.68,
     & -5.84, -3.65, -1.43,   .90,  3.25,  5.77,  9.96, 14.30, 18.65,
     & -5.87, -3.59, -1.27,  1.15,  3.55,  6.15, 10.31, 14.48, 18.65,
     & -5.88, -3.23,  -.17,  2.55,  5.11,  8.26, 11.68, 15.09, 18.51,
     & -6.06, -3.03,   .37,  3.32,  6.38,  9.69, 12.99, 16.30, 19.60,
     & -6.21, -2.96,   .43,  3.93,  7.64, 11.21, 14.79, 18.36, 21.93/
      DATA((ALP212(J,N),N=1,9),J=1,13)/
     & -6.11, -3.92, -1.71,   .62,  2.97,  5.81,  8.88, 11.95, 15.03,
     & -6.16, -3.97, -1.75,   .52,  2.68,  5.28,  8.13, 11.03, 13.93,
     & -6.21, -3.99, -1.77,   .37,  2.49,  4.84,  7.44, 10.32, 13.19,
     & -6.27, -4.02, -1.79,   .29,  2.37,  4.65,  7.02,  9.78, 12.54,
     & -6.30, -4.06, -1.83,   .18,  2.24,  4.40,  6.55,  9.18, 11.82,
     & -6.30, -4.07, -1.85,   .14,  2.14,  4.28,  6.33,  9.58, 12.83,
     & -6.32, -4.09, -1.87,   .09,  2.05,  4.16,  6.58, 12.05, 17.53,
     & -6.29, -4.09, -1.90,   .04,  1.96,  4.01,  8.18, 15.32, 22.46,
     & -6.18, -4.03, -1.89,   .02,  2.01,  4.52, 10.21, 17.36, 24.50,
     & -5.83, -3.80, -1.78,   .15,  2.53,  5.56, 12.44, 19.85, 27.26,
     & -5.38, -3.44, -1.49,   .61,  3.33,  7.13, 14.68, 22.23, 29.77,
     & -4.61, -2.73,  -.79,  1.38,  4.29,  9.31, 17.00, 24.69, 32.38,
     & -3.90, -1.98,  -.11,  2.06,  5.12, 11.19, 18.59, 26.00, 33.41/
      DATA((ALP212(J,N),N=1,9),J=14,26)/
     & -3.58, -1.64,   .25,  2.54,  5.39, 11.61, 18.75, 25.89, 33.04,
     & -3.91, -1.89,  -.01,  2.20,  4.91, 10.35, 17.37, 24.39, 31.40,
     & -4.83, -2.36,  -.42,  1.68,  4.23,  8.72, 15.28, 21.84, 28.39,
     & -5.60, -2.93,  -.81,  1.20,  3.63,  7.33, 13.39, 19.45, 25.52,
     & -5.73, -3.26, -1.08,   .93,  3.42,  6.82, 12.88, 18.94, 25.00,
     & -5.63, -3.13,  -.98,  1.06,  3.59,  7.13, 13.10, 19.07, 25.04,
     & -5.50, -3.00,  -.89,  1.20,  3.79,  7.47, 13.03, 18.58, 24.14,
     & -5.40, -2.88,  -.79,  1.35,  3.99,  7.79, 12.99, 18.18, 23.38,
     & -5.30, -2.75,  -.69,  1.51,  4.22,  8.05, 12.87, 17.69, 22.51,
     & -5.21, -2.64,  -.60,  1.67,  4.44,  8.27, 12.82, 17.36, 21.91,
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     & -4.80, -2.04,  -.11,  2.64,  5.73,  9.39, 13.09, 16.80, 20.50,
     & -4.58, -1.83,   .31,  3.48,  6.82, 10.02, 13.22, 16.42, 19.62,
     & -4.50, -1.79,   .52,  4.26,  7.61, 10.86, 14.11, 17.37, 20.62/
      DATA((ALP215(J,N),N=1,9),J=1,13)/
     & -6.27, -3.86, -1.39,  1.03,  3.57,  6.88, 10.69, 14.50, 18.30,
     & -6.22, -3.79, -1.38,   .87,  3.22,  6.29,  9.89, 13.50, 17.10,
     & -6.05, -3.68, -1.35,   .78,  2.94,  5.74,  9.10, 12.49, 15.88,
     & -6.00, -3.63, -1.33,   .73,  2.78,  5.41,  8.54, 11.74, 14.94,
     & -5.87, -3.55, -1.32,   .66,  2.62,  4.92,  7.92, 11.25, 14.58,
     & -5.82, -3.50, -1.32,   .61,  2.55,  4.82,  8.04, 11.74, 15.44,
     & -5.76, -3.46, -1.31,   .57,  2.55,  5.03,  8.84, 13.23, 17.63,
     & -5.69, -3.39, -1.27,   .59,  2.69,  5.59, 11.77, 18.43, 25.10,
     & -5.33, -3.04, -1.06,   .73,  3.11,  7.76, 15.61, 23.45, 31.29,
     & -4.69, -2.39,  -.69,  1.19,  4.34, 10.94, 18.78, 26.63, 34.47,
     & -3.81, -1.73,  -.16,  2.39,  6.31, 14.00, 21.69, 29.38, 37.08,
     & -2.99, -1.12,   .92,  3.62,  9.35, 17.04, 24.73, 32.42, 40.12,
     & -2.80,  -.83,  1.21,  4.09,  9.80, 16.58, 23.36, 30.14, 36.92/
      DATA((ALP215(J,N),N=1,9),J=14,26)/
     & -3.04, -1.08,   .85,  3.50,  8.92, 17.25, 25.58, 33.92, 42.25,
     & -3.79, -1.65,   .22,  2.38,  6.12, 13.96, 21.80, 29.65, 37.49,
     & -4.92, -2.85,  -.45,  1.64,  4.94, 11.29, 18.43, 25.57, 32.71,
     & -5.94, -3.53,  -.91,  1.48,  4.51, 10.35, 16.81, 23.26, 29.71,
     & -5.79, -3.44,  -.90,  1.55,  4.73, 10.47, 16.72, 22.97, 29.22,
     & -5.82, -3.41,  -.84,  1.66,  4.95, 10.61, 16.67, 22.73, 28.79,
     & -5.85, -3.38,  -.77,  1.76,  5.15, 10.71, 16.59, 22.47, 28.35,
     & -5.87, -3.36,  -.70,  1.85,  5.34, 10.80, 16.51, 22.23, 27.94,
     & -5.86, -3.33,  -.65,  1.95,  5.51, 10.89, 16.44, 22.00, 27.56,
     & -5.86, -3.31,  -.59,  2.07,  5.68, 10.97, 16.38, 21.78, 27.19,
     & -5.87, -3.20,  -.20,  2.81,  6.60, 11.20, 15.79, 20.39, 24.99,
     & -5.86, -3.10,   .06,  3.39,  7.12, 11.33, 15.54, 19.75, 23.96,
     & -5.87, -2.99,   .21,  3.78,  7.35, 11.19, 15.04, 18.88, 22.73/
      DATA((ALP218(J,N),N=1,9),J=1,13)/
     & -6.44, -3.84, -1.23,  1.22,  3.82,  8.00, 12.17, 16.33, 20.50,
     & -6.20, -3.74, -1.28,  1.12,  3.66,  7.24, 11.16, 15.08, 19.00,
     & -5.83, -3.54, -1.27,  1.01,  3.51,  6.59,  9.98, 13.37, 16.76,
     & -5.60, -3.41, -1.23,   .95,  3.41,  6.19,  9.39, 12.59, 15.79,
     & -5.32, -3.24, -1.21,   .88,  3.27,  5.72,  9.08, 12.56, 16.03,
     & -5.19, -3.15, -1.18,   .86,  3.32,  6.05, 10.64, 15.24, 19.84,
     & -5.04, -3.01, -1.06,  1.12,  3.89,  7.73, 12.27, 16.82, 21.36,
     & -4.82, -2.56,  -.47,  1.90,  5.04, 10.00, 15.33, 20.67, 26.00,
     & -4.30, -1.97,   .26,  2.77,  6.79, 13.14, 19.49, 25.84, 32.19,
     & -3.75, -1.34,  1.03,  3.68,  9.96, 17.96, 25.96, 33.96, 41.96,
     & -3.22,  -.64,  1.71,  5.03, 15.26, 26.69, 38.11, 49.54, 60.97,
     & -2.92,  -.25,  2.19,  5.93, 19.59, 33.38, 47.17, 60.97, 74.76,
     & -3.25,  -.75,  1.81,  5.36, 18.36, 32.64, 46.93, 61.21, 75.50/
      DATA((ALP218(J,N),N=1,9),J=14,26)/
     & -3.90, -1.78,   .87,  3.56, 12.43, 26.71, 41.00, 55.29, 69.57,
     & -4.67, -2.47,  -.04,  2.37,  7.00, 18.11, 29.22, 40.33, 51.44,
     & -5.35, -2.98,  -.45,  1.91,  5.66, 16.88, 28.65, 40.41, 52.18,
     & -5.55, -3.09,  -.44,  1.97,  5.86, 17.09, 28.51, 39.94, 51.37,
     & -5.59, -3.09,  -.40,  2.05,  6.12, 17.88, 29.65, 41.41, 53.18,
     & -5.62, -3.09,  -.36,  2.14,  6.59, 18.35, 30.12, 41.88, 53.65,
     & -5.63, -3.08,  -.32,  2.23,  7.12, 18.88, 30.65, 42.41, 54.18,
     & -5.63, -3.06,  -.28,  2.32,  7.59, 19.35, 31.12, 42.88, 54.65,
     & -5.62, -3.05,  -.25,  2.42,  8.06, 20.18, 32.30, 44.42, 56.55,
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& -5.60, -3.04,  -.22,  2.52,  8.48, 20.61, 32.73, 44.85, 56.97,
& -5.54, -2.93,  -.05,  3.14, 11.23, 24.13, 37.03, 49.94, 62.84,
& -5.58, -2.86,   .13,  3.71, 14.62, 30.00, 45.38, 60.77, 76.15,
& -5.42, -2.82,   .15,  4.24, 18.82, 37.00, 55.18, 73.36, 91.55/
 DATA((ALP221(J,N),N=1,9),J=1,13)/
& -5.73, -3.15,  -.77,  1.54,  5.20, 10.80, 16.13, 21.47, 26.80,
& -5.85, -3.15,  -.76,  1.66,  5.04,  9.34, 13.34, 17.34, 21.34,
& -5.95, -3.30,  -.83,  1.59,  4.54,  8.24, 11.72, 15.20, 18.68,
& -6.10, -3.49,  -.95,  1.45,  4.30,  7.61, 10.76, 13.91, 17.06,
& -6.16, -3.68, -1.14,  1.39,  4.21,  7.60, 11.21, 14.81, 18.41,
& -6.08, -3.69, -1.17,  1.52,  4.42,  8.55, 12.76, 16.97, 21.18,
& -6.05, -3.58,  -.98,  2.05,  5.53, 11.63, 17.78, 23.94, 30.09,
& -5.93, -3.25,  -.33,  2.99,  8.63, 16.96, 25.29, 33.63, 41.96,
& -5.19, -2.49,   .84,  4.52, 13.14, 22.23, 31.32, 40.41, 49.50,
& -4.42, -1.32,  2.23,  8.43, 17.13, 25.83, 34.52, 43.22, 51.91,
& -3.52,  -.42,  3.15, 11.86, 25.66, 39.45, 53.24, 67.03, 80.83,
& -3.71,  -.75,  2.90, 11.73, 29.91, 48.09, 66.27, 84.45,102.64,
& -4.90, -1.96,  1.06,  5.24, 19.60, 35.60, 51.60, 67.60, 83.60/
 DATA((ALP221(J,N),N=1,9),J=14,26)/
& -6.23, -3.11,  -.57,  2.95, 10.40, 21.83, 33.26, 44.69, 56.11,
& -6.63, -3.82, -1.08,  2.40,  9.07, 23.36, 37.64, 51.93, 66.21,
& -6.84, -3.85, -1.01,  2.44,  9.41, 24.22, 39.04, 53.85, 68.67,
& -6.79, -3.76,  -.91,  2.57,  9.86, 23.66, 37.45, 51.24, 65.03,
& -6.70, -3.65,  -.81,  2.73, 10.00, 21.76, 33.53, 45.29, 57.06,
& -6.64, -3.53,  -.70,  2.90, 10.27, 21.08, 31.89, 42.70, 53.51,
& -6.55, -3.42,  -.59,  3.06, 10.65, 21.46, 32.27, 43.08, 53.89,
& -6.49, -3.32,  -.50,  3.20, 11.08, 21.89, 32.70, 43.51, 54.32,
& -6.46, -3.20,  -.39,  3.35, 11.46, 22.27, 33.08, 43.89, 54.70,
& -6.42, -3.08,  -.31,  3.47, 12.00, 23.11, 34.22, 45.33, 56.44,
& -6.85, -2.69,  0.00,  4.30, 15.00, 27.50, 40.00, 52.50, 65.00,
& -6.61, -2.65,   .14,  4.89, 17.03, 30.83, 44.62, 58.41, 72.21,
& -6.31, -2.61,   .18,  5.30, 17.80, 31.13, 44.47, 57.80, 71.13/
 DATA((CD204(I,J),J=1,26),I=1,5)/
1 .0061, .0061, .0061, .0061, .0061, .0062, .0062, .0062, .0062,
1 .0062, .0063, .0064, .0076, .0113, .0169, .0211, .0245, .0270,
1 .0296, .0310, .0320, .0329, .0332, .0292, .0221, .0170,
2 .0047, .0046, .0046, .0045, .0045, .0045, .0045, .0045, .0045,
2 .0045, .0045, .0047, .0055, .0098, .0152, .0192, .0225, .0249,
2 .0270, .0290, .0303, .0316, .0325, .0317, .0299, .0283,
3 .0065, .0058, .0055, .0055, .0054, .0054, .0054, .0054, .0055,
3 .0055, .0057, .0066, .0096, .0153, .0210, .0250, .0284, .0304,
3 .0324, .0344, .0361, .0375, .0389, .0469, .0546, .0619,
4 .0219, .0168, .0144, .0133, .0128, .0126, .0128, .0130, .0138,
4 .0154, .0187, .0220, .0264, .0321, .0377, .0434, .0496, .0559,
4 .0623, .0686, .0750, .0788, .0823, .0979, .1077, .1194,
5 .0575, .0328, .0227, .0202, .0188, .0182, .0184, .0189, .0205,
5 .0236, .0317, .0403, .0489, .0586, .0701, .0817, .0928, .1036,
5 .1143, .1220, .1284, .1348, .1412, .1692, .1842, .1890/
 DATA((CD206(I,J),J=1,26),I=1,5)/
1 .0059, .0059, .0060, .0060, .0061, .0061, .0061, .0061, .0061,
1 .0062, .0062, .0067, .0112, .0173, .0235, .0289, .0333, .0364,
1 .0385, .0397, .0405, .0406, .0407, .0370, .0313, .0253,
2 .0044, .0044, .0044, .0044, .0044, .0044, .0044, .0044, .0044,
2 .0045, .0046, .0055, .0101, .0162, .0222, .0275, .0312, .0340,
2 .0360, .0377, .0387, .0396, .0400, .0398, .0365, .0325,
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3 .0068, .0055, .0053, .0053, .0053, .0053, .0053, .0053, .0053,
3 .0053, .0057, .0082, .0132, .0209, .0273, .0319, .0354, .0375,
3 .0394, .0413, .0430, .0446, .0462, .0547, .0611, .0657,
4 .0173, .0125, .0095, .0085, .0082, .0082, .0083, .0087, .0090,
4 .0099, .0121, .0169, .0224, .0334, .0448, .0549, .0639, .0711,
4 .0772, .0834, .0877, .0918, .0958, .1116, .1178, .1234,
5 .0377, .0292, .0227, .0195, .0182, .0183, .0184, .0188, .0202,
5 .0229, .0267, .0304, .0395, .0666, .0956, .1136, .1271, .1380,
5 .1474, .1568, .1654, .1737, .1820, .2120, .2260, .2238/
 DATA((CD209(I,J),J=1,26),I=1,5)/
1 .0064, .0064, .0063, .0063, .0063, .0063, .0063, .0063, .0063,
1 .0063, .0068, .0089, .0138, .0201, .0278, .0356, .0426, .0481,
1 .0529, .0561, .0577, .0577, .0577, .0573, .0516, .0449,
2 .0055, .0053, .0054, .0056, .0058, .0059, .0059, .0060, .0062,
2 .0065, .0073, .0106, .0156, .0213, .0269, .0322, .0373, .0423,
2 .0471, .0515, .0560, .0582, .0598, .0601, .0567, .0526,
3 .0074, .0070, .0066, .0065, .0066, .0066, .0066, .0067, .0070,
3 .0072, .0088, .0143, .0213, .0287, .0359, .0432, .0496, .0555,
3 .0603, .0645, .0675, .0702, .0719, .0769, .0817, .0866,
4 .0124, .0109, .0101, .0098, .0097, .0097, .0101, .0105, .0113,
4 .0135, .0188, .0241, .0348, .0514, .0648, .0764, .0861, .0948,
4 .1022, .1087, .1135, .1183, .1231, .1335, .1384, .1432,
5 .0285, .0214, .0178, .0162, .0156, .0156, .0159, .0168, .0190,
5 .0241, .0371, .0537, .0706, .0863, .1003, .1126, .1245, .1354,
5 .1464, .1565, .1641, .1716, .1785, .1939, .1971, .2003/
 DATA((CD212(I,J),J=1,26),I=1,5)/
1 .0073, .0073, .0073, .0072, .0072, .0072, .0072, .0072, .0073,
1 .0081, .0127, .0228, .0329, .0416, .0506, .0585, .0658, .0727,
1 .0793, .0833, .0862, .0877, .0887, .0889, .0816, .0704,
2 .0060, .0057, .0057, .0056, .0056, .0056, .0058, .0059, .0064,
2 .0075, .0118, .0189, .0272, .0361, .0448, .0530, .0599, .0667,
2 .0734, .0789, .0831, .0865, .0880, .0903, .0845, .0746,
3 .0081, .0078, .0078, .0078, .0080, .0081, .0083, .0090, .0104,
3 .0129, .0173, .0262, .0353, .0437, .0520, .0606, .0693, .0772,
3 .0843, .0902, .0952, .0986, .1013, .1051, .1046, .1040,
4 .0136, .0131, .0129, .0128, .0129, .0131, .0133, .0146, .0172,
4 .0247, .0348, .0472, .0590, .0703, .0829, .0940, .1035, .1125,
4 .1208, .1280, .1336, .1392, .1430, .1543, .1560, .1505,
5 .0215, .0205, .0201, .0201, .0204, .0212, .0239, .0305, .0403,
5 .0559, .0753, .0955, .1132, .1295, .1455, .1615, .1713, .1780,
5 .1841, .1891, .1940, .1989, .2027, .2213, .2368, .2420/
 DATA((CD215(I,J),J=1,26),I=1,5)/
1 .0074, .0076, .0077, .0078, .0078, .0078, .0080, .0087, .0109,
1 .0200, .0300, .0403, .0507, .0613, .0718, .0809, .0900, .0992,
1 .1062, .1130, .1199, .1267, .1301, .1302, .1187, .1041,
2 .0074, .0076, .0077, .0078, .0078, .0078, .0080, .0087, .0108,
2 .0198, .0300, .0404, .0507, .0612, .0718, .0824, .0909, .0986,
2 .1063, .1134, .1198, .1261, .1324, .1315, .1228, .1103,
3 .0099, .0099, .0100, .0103, .0109, .0112, .0118, .0128, .0173,
3 .0268, .0369, .0474, .0584, .0701, .0806, .0893, .0981, .1062,
3 .1142, .1221, .1299, .1334, .1369, .1433, .1409, .1373,
4 .0159, .0170, .0175, .0178, .0182, .0195, .0218, .0273, .0370,
4 .0494, .0618, .0741, .0863, .0979, .1086, .1193, .1299, .1383,
4 .1458, .1534, .1609, .1675, .1711, .1838, .1864, .1890,
5 .0260, .0245, .0248, .0246, .0262, .0281, .0315, .0433, .0618,
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5 .0822, .1021, .1194, .1363, .1526, .1689, .1847, .1992, .2138,
5 .2283, .2359, .2429, .2499, .2570, .2727, .2772, .2816/
 DATA((CD218(I,J),J=1,26),I=1,5)/
1 .0096, .0101, .0103, .0104, .0108, .0112, .0122, .0144, .0207,
1 .0335, .0493, .0630, .0743, .0847, .0951, .1043, .1122, .1200,
1 .1273, .1322, .1370, .1418, .1450, .1525, .1524, .1482,
2 .0084, .0085, .0085, .0086, .0086, .0088, .0094, .0114, .0223,
2 .0354, .0514, .0655, .0777, .0891, .0994, .1083, .1173, .1248,
2 .1305, .1361, .1414, .1459, .1503, .1589, .1559, .1516,
3 .0130, .0141, .0147, .0150, .0154, .0159, .0175, .0208, .0308,
3 .0454, .0611, .0758, .0868, .0978, .1088, .1178, .1263, .1349,
3 .1416, .1468, .1520, .1572, .1601, .1677, .1710, .1742,
4 .0222, .0262, .0282, .0292, .0302, .0307, .0323, .0414, .0630,
4 .0793, .0966, .1118, .1246, .1375, .1486, .1589, .1692, .1760,
4 .1816, .1871, .1926, .1969, .2002, .2161, .2230, .2265,
5 .0358, .0414, .0441, .0455, .0495, .0565, .0661, .0841, .1029,
5 .1219, .1492, .1758, .1958, .2158, .2321, .2471, .2621, .2717,
5 .2812, .2908, .3003, .3008, .3008, .3028, .3071, .3114/
 DATA((CD221(I,J),J=1,26),I=1,5)/
1 .0098, .0137, .0146, .0153, .0159, .0165, .0174, .0199, .0267,
1 .0388, .0521, .0660, .0801, .0942, .1069, .1186, .1304, .1421,
1 .1526, .1625, .1724, .1793, .1834, .1860, .1868, .1876,
2 .0111, .0111, .0111, .0114, .0117, .0123, .0130, .0196, .0321,
2 .0443, .0569, .0697, .0832, .0963, .1083, .1203, .1331, .1470,
2 .1608, .1706, .1793, .1878, .1918, .1926, .1945, .1964,
3 .0154, .0164, .0169, .0172, .0176, .0180, .0202, .0305, .0450,
3 .0601, .0752, .0902, .1045, .1188, .1325, .1455, .1586, .1688,
3 .1772, .1856, .1940, .2024, .2064, .2181, .2191, .2202,
4 .0369, .0324, .0332, .0350, .0375, .0434, .0577, .0719, .0862,
4 .1012, .1169, .1326, .1463, .1597, .1732, .1849, .1959, .2069,
4 .2165, .2245, .2325, .2405, .2479, .2562, .2572, .2583,
5 .0670, .0511, .0528, .0547, .0607, .0771, .0969, .1168, .1348,
5 .1527, .1705, .1893, .2084, .2276, .2461, .2643, .2825, .3007,
5 .3055, .3084, .3113, .3136, .3138, .3149, .3160, .3172/
 DATA(XMI(J),J=1,26)/.3,.5,.6,.65,.7,.725,.75,.775,
& .8,.825,.85,.875,.9,.925,.95,.975,1.0,1.025,1.05,1.075,
&1.1,1.125,1.15,1.3,1.45,1.6/
 DATA(CLI(J),J=1,9)/-.4,-.2,0.0,.2,.4,.6,.8,1.0,1.2/
 DATA(ALPI(J),J=1,7)/-4.0,-2.0,0.0,2.0,4.0,6.0,8.0/
 DATA(CLII(J),J=1,5)/0.0,.2,.4,.6,.8/
 IORDER(1)=IORDER(2)=1
 IPT (1) = -1
 IF (IKEY .EQ. 2) GO TO 1000
 IF (TR .LT. .04) GO TO 9
 IF (TR .GE. .04 .AND. TR .LT. .06) GO TO 1
 IF (TR .GE. .06 .AND. TR .LT. .09) GO TO 2
 IF (TR .GE. .09 .AND. TR .LT. .12) GO TO 3
 IF (TR .GE. .12 .AND. TR .LT. .15) GO TO 4
 IF (TR .GE. .15 .AND. TR .LT. .18) GO TO 5
 IF (TR .GE. .18 .AND. TR .LT. .21) GO TO 6
 IF (TR .GE. .21) GO TO 7
9 CALL IBI (7,ALPI,26,XMI,7,CL204,IORDER,IPT,AA,XM,CLFT04,IERR)
 CL=CLFT04
 GO TO 400
1 CALL IBI (7,ALPI,26,XMI,7,CL204,IORDER,IPT,AA,XM,CLFT04,IERR)
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      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL206,IORDER,IPT,AA,XM,CLFT06,IERR)
      CL=CLFT04 + (CLFT06-CLFT04)*((TR-.04)/(.06-.04))
      GO TO 400
    2 CALL IBI (7,ALPI,26,XMI,7,CL206,IORDER,IPT,AA,XM,CLFT06,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL209,IORDER,IPT,AA,XM,CLFT09,IERR)
      CL=CLFT06 + (CLFT09 - CLFT06)*((TR-.06)/(.09-.06))
      GO TO 400
    3 CALL IBI (7,ALPI,26,XMI,7,CL209,IORDER,IPT,AA,XM,CLFT09,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL212,IORDER,IPT,AA,XM,CLFT12,IERR)
      CL=CLFT09+(CLFT12-CLFT09)*((TR-.09)/(.12-.09))
      GO TO 400
    4 CALL IBI (7,ALPI,26,XMI,7,CL212,IORDER,IPT,AA,XM,CLFT12,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL215,IORDER,IPT,AA,XM,CLFT15,IERR)
      CL=CLFT12 + (CLFT15-CLFT12)*((TR-.12)/(.15-.12))
      GO TO 400
    5 CALL IBI (7,ALPI,26,XMI,7,CL215,IORDER,IPT,AA,XM,CLFT15,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL218,IORDER,IPT,AA,XM,CLFT18,IERR)
      CL=CLFT15+(CLFT18-CLFT15)*((TR-.15)/(.18-.15))
      GO TO 400
    6 CALL IBI (7,ALPI,26,XMI,7,CL218,IORDER,IPT,AA,XM,CLFT18,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL221,IORDER,IPT,AA,XM,CLFT21,IERR)
      CL=CLFT18+(CLFT21-CLFT18)*((TR-.18)/(.21-.18))
      GO TO 400
    7 CALL IBI (7,ALPI,26,XMI,7,CL221,IORDER,IPT,AA,XM,CLFT21,IERR)
      CL=CLFT21
      GO TO 400
 1000 CONTINUE
      IPT (1)=-1
      IF (TR .LT. .04) GO TO 90
      IF (TR .GE. .04 .AND. TR .LT. .06) GO TO 10
      IF (TR .GE. .06 .AND. TR .LT. .09) GO TO 20
      IF (TR .GE. .09 .AND. TR .LT. .12) GO TO 30
      IF (TR .GE. .12 .AND. TR .LT. .15) GO TO 40
      IF (TR .GE. .15 .AND. TR .LT. .18) GO TO 50
      IF (TR .GE. .18 .AND. TR .LT. .21) GO TO 60
      IF (TR .GE. .21) GO TO 70
   90 CALL IBI (26,XMI,9,CLI,26,ALP204,IORDER,IPT,XM,CL,AA04,IERR)
      AA=AA04
      GO TO 400
   10 CALL IBI (26,XMI,9,CLI,26,ALP204,IORDER,IPT,XM,CL,AA04,IERR)
      IPT (1) = -1
      CALL IBI (26,XMI,9,CLI,26,ALP206,IORDER,IPT,XM,CL,AA06,IERR)
      AA=AA04 + (AA06-AA04)*((TR-.04)/(.06-.04))
      GO TO 400
   20 CALL IBI (26,XMI,9,CLI,26,ALP206,IORDER,IPT,XM,CL,AA06,IERR)
      IPT (1) = -1
      CALL IBI (26,XMI,9,CLI,26,ALP209,IORDER,IPT,XM,CL,AA09,IERR)
      AA=AA06 + (AA09 - AA06)*((TR -.06)/(.09-.06))
      GO TO 400
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 30   CALL IBI (26,XMI,9,CLI,26,ALP209,IORDER,IPT,XM,CL,AA09,IERR)
      IPT (1) = -1
      CALL IBI (26,XMI,9,CLI,26,ALP212,IORDER,IPT,XM,CL,AA12,IERR)
      AA=AA09+(AA12-AA09)*((TR-.09)/(.12-.09))
      GO TO 400
 40   CALL IBI (26,XMI,9,CLI,26,ALP212,IORDER,IPT,XM,CL,AA12,IERR)
      IPT (1) = -1
      CALL IBI (26,XMI,9,CLI,26,ALP215,IORDER,IPT,XM,CL,AA15,IERR)
      AA=AA12+(AA15-AA12)*((TR-.12)/(.15-.12))
      GO TO 400
 50   CALL IBI (26,XMI,9,CLI,26,ALP215,IORDER,IPT,XM,CL,AA15,IERR)
      IPT (1) = -1
      CALL IBI (26,XMI,9,CLI,26,ALP218,IORDER,IPT,XM,CL,AA18,IERR)
      AA=AA15+(AA18-AA15)*((TR-.15)/(.18-.15))
      GO TO 400
 60   CALL IBI (26,XMI,9,CLI,26,ALP218,IORDER,IPT,XM,CL,AA18,IERR)
      IPT (1) = -1
      CALL IBI (26,XMI,9,CLI,26,ALP221,IORDER,IPT,XM,CL,AA21,IERR)
      AA=AA18+(AA21-AA18)*((TR-.18)/(.21-.18))
      GO TO 400
 70   CALL IBI (26,XMI,9,CLI,26,ALP221,IORDER,IPT,XM,CL,AA21,IERR)
      AA=AA21
400   CONTINUE
      IPT (1)=-1
      IF (TR .LT. .04) GO TO 91
      IF (TR .GE. .04 .AND. TR .LT. .06) GO TO 11
      IF (TR .GE. .06 .AND. TR .LT. .09) GO TO 21
      IF (TR .GE. .09 .AND. TR .LT. .12) GO TO 31
      IF (TR .GE. .12 .AND. TR .LT. .15) GO TO 41
      IF (TR .GE. .15 .AND. TR .LT. .18) GO TO 51
      IF (TR .GE. .18 .AND. TR .LT. .21) GO TO 61
      IF (TR .GE. .21) GO TO 71
 91   CALL IBI (5,CLII,26,XMI,5,CD204,IORDER,IPT,CL,XM,CDRG04,IERR)
      CD=CDRG04
      WRITE (6,201) TR
201   FORMAT(*0THICKNESS RATIO=*,F5.3,* IS OUT OF RANGE.
     &*/* THE VALUES FOR T/C=.04 HAVE BEEN RETURNED*)
      GO TO 250
11    CALL IBI (5,CLII,26,XMI,5,CD204,IORDER,IPT,CL,XM,CDRG04,IERR)
      IPT (1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD206,IORDER,IPT,CL,XM,CDRG06,IERR)
      CD=CDRG04 + (CDRG06-CDRG04)*((TR-.04)/(.06-.04))
      GO TO 250
 21   CALL IBI (5,CLII,26,XMI,5,CD206,IORDER,IPT,CL,XM,CDRG06,IERR)
      IPT (1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD209,IORDER,IPT,CL,XM,CDRG09,IERR)
      CD=CDRG06 + (CDRG09 - CDRG06)*((TR-.06)/(.09-.06))
      GO TO 250
 31   CALL IBI (5,CLII,26,XMI,5,CD209,IORDER,IPT,CL,XM,CDRG09,IERR)
      IPT (1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD212,IORDER,IPT,CL,XM,CDRG12,IERR)
      CD=CDRG09+(CDRG12-CDRG09)*((TR-.09)/(.12-.09))
      GO TO 250
 41   CALL IBI (5,CLII,26,XMI,5,CD212,IORDER,IPT,CL,XM,CDRG12,IERR)
      IPT (1)=-1
```

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      CALL IBI (5,CLII,26,XMI,5,CD215,IORDER,IPT,CL,XM,CDRG15,IERR)
      CD=CDRG12 + (CDRG15-CDRG12)*((TR-.12)/(.15-.12))
      GO TO 250
   51 CALL IBI (5,CLII,26,XMI,5,CD215,IORDER,IPT,CL,XM,CDRG15,IERR)
      IPT (1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD218,IORDER,IPT,CL,XM,CDRG18,IERR)
      CD=CDRG15+(CDRG18-CDRG15)*((TR-.15)/(.18-.15))
      GO TO 250
   61 CALL IBI (5,CLII,26,XMI,5,CD218,IORDER,IPT,CL,XM,CDRG18,IERR)
      IPT (1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD221,IORDER,IPT,CL,XM,CDRG21,IERR)
      CD=CDRG18+(CDRG21-CDRG18)*((TR-.18)/(.21-.18))
      GO TO 250
   71 CALL IBI (5,CLII,26,XMI,5,CD221,IORDER,IPT,CL,XM,CDRG21,IERR)
      CD=CDRG21
      IF (TR .GT. .21) WRITE(6,204) TR
  204 FORMAT(*0THICKNESS RATIO=*,F5.3,* IS OUT OF RANGE.
     &*/* THE VALUES FOR T/C=.21 HAVE BEEN RETURNED.*)
  250 IF(CL .GT. .8) GO TO 251
      RETURN
  251 CALL COMPUT(D,XM,ALT,COR,TR,AA,CDT,CL,CD,CLDES)
      CD=CDT
      RETURN
      END


      SUBROUTINE AERO3(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
C
C
C THIS SUBROUTINE IS DESIGNED TO COMPUTE THE AIRFOIL
C CHARACTERISTICS FOR A 16 SERIES AIRFOIL WITH A GIVEN CAMBER.
C
C THIS SUBROUTINE RELATES CL,CD,CL/CD,MACH,T/C,AND ALPHA.
C IT REPRESENTS THE DATA OF A 16-3XX AIRFOIL.
C
C XM=RELATIVE MACH NO. AT BLADE ELEMENT
C AA=ANGLE OF ATTACK IN DEGREES
C IKEY1: CL=CL(MACH,ALPHA,T/C)
C      : CD=CD(MACH,CL,T/C)
C      :XLD=CL/CD
C IKEY2: ALPHA=ALPHA(MACH,CL,T/C)
C      : CD=CD(MACH,CL,T/C)
C      :XLD=CL/CD
C TR=T/C
C
C
C
C
      DIMENSION IORDER(2),IPT(2),ALP304(26,9),ALP306(26,9),
     & ALP309(26,9),ALP312(26,9),ALP315(26,9),ALP318(26,9),
     & ALP321(26,9),CLI(9),XMI(26),ALPI(7),CL304(7,26),
     & CL306(7,26),CL309(7,26),CL312(7,26),CL315(7,26),
     & CL318(7,26),CL321(7,26),CD304(5,26),CD306(5,26),
     & CD309(5,26),CD312(5,26),CD315(5,26),CD318(5,26),
```

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& CD321(5,26),CLII(5)
 DATA((CL304(I,J),J=1,26),I=1,4)/
1 -.184, -.211, -.232, -.245, -.265, -.276, -.287, -.301, -.316,
1 -.327, -.325, -.314, -.289, -.263, -.242, -.226, -.215, -.210,
1 -.212, -.219, -.232, -.244, -.255, -.281, -.294, -.295,
2  .052,  .055,  .061,  .064,  .067,  .069,  .073,  .077,  .080,
2  .084,  .090,  .096,  .102,  .107,  .103,  .078,  .027, -.002,
2  .021,  .050,  .065,  .077,  .070, -.038, -.116, -.141,
3  .262,  .284,  .305,  .319,  .334,  .341,  .349,  .357,  .368,
3  .378,  .390,  .407,  .407,  .381,  .345,  .308,  .272,  .258,
3  .273,  .300,  .327,  .330,  .306,  .154,  .028, -.024,
4  .492,  .514,  .533,  .547,  .561,  .569,  .580,  .590,  .601,
4  .613,  .628,  .643,  .637,  .606,  .575,  .543,  .511,  .499,
4  .521,  .544,  .568,  .569,  .534,  .320,  .148,  .084/
 DATA((CL304(I,J),J=1,26),I=5,7)/
5  .656,  .696,  .735,  .761,  .794,  .810,  .831,  .853,  .869,
5  .875,  .866,  .846,  .826,  .797,  .768,  .739,  .717,  .708,
5  .734,  .759,  .780,  .781,  .740,  .464,  .266,  .200,
6  .831,  .888,  .930,  .958,  .991, 1.015, 1.036, 1.035, 1.023,
6 1.011,  .994,  .977,  .960,  .943,  .925,  .903,  .881,  .870,
6  .893,  .924,  .957,  .945,  .900,  .608,  .393,  .306,
7  .977, 1.028, 1.069, 1.097, 1.137, 1.149, 1.155, 1.156, 1.151,
7 1.138, 1.126, 1.109, 1.090, 1.070, 1.051, 1.031, 1.011, 1.006,
7 1.026, 1.050, 1.072, 1.077, 1.038,  .746,  .524,  .415/
 DATA((CL306(I,J),J=1,26),I=1,4)/
1 -.184, -.180, -.178, -.173, -.168, -.165, -.159, -.152, -.146,
1 -.139, -.131, -.123, -.119, -.171, -.246, -.320, -.374, -.346,
1 -.301, -.256, -.221, -.223, -.232, -.287, -.322, -.305,
2  .073,  .071,  .075,  .078,  .084,  .089,  .096,  .102,  .109,
2  .119,  .129,  .137,  .115,  .056, -.003, -.063, -.087, -.063,
2 -.025,  .012,  .023,  .010, -.003, -.080, -.134, -.129,
3  .276,  .292,  .312,  .325,  .338,  .348,  .357,  .367,  .377,
3  .387,  .397,  .395,  .355,  .304,  .252,  .201,  .182,  .200,
3  .238,  .275,  .295,  .282,  .259,  .120,  .020, -.015,
4  .501,  .514,  .537,  .554,  .572,  .581,  .590,  .599,  .618,
4  .636,  .645,  .608,  .565,  .521,  .477,  .433,  .413,  .447,
4  .483,  .520,  .523,  .495,  .462,  .266,  .129,  .093/
 DATA((CL306(I,J),J=1,26),I=5,7)/
5  .655,  .691,  .737,  .763,  .789,  .803,  .821,  .838,  .843,
5  .828,  .797,  .761,  .725,  .689,  .653,  .620,  .606,  .635,
5  .667,  .699,  .714,  .691,  .647,  .385,  .249,  .208,
6  .815,  .867,  .919,  .952,  .985, 1.001, 1.004,  .989,  .963,
6  .936,  .909,  .882,  .848,  .813,  .779,  .744,  .728,  .749,
6  .782,  .814,  .837,  .821,  .782,  .553,  .396,  .322,
7  .955, 1.003, 1.054, 1.087, 1.126, 1.134, 1.125, 1.113, 1.083,
7 1.053, 1.023,  .993,  .963,  .932,  .902,  .875,  .854,  .873,
7  .908,  .944,  .968,  .949,  .921,  .700,  .534,  .417/
 DATA((CL309(I,J),J=1,26),I=1,4)/
1 -.146, -.146, -.134, -.127, -.120, -.116, -.113, -.109, -.105,
1 -.095, -.140, -.232, -.341, -.416, -.416, -.385, -.322, -.279,
1 -.273, -.274, -.274, -.275, -.275, -.283, -.287, -.281,
2  .058,  .062,  .069,  .073,  .079,  .082,  .085,  .089,  .097,
2  .103,  .071, -.013, -.112, -.184, -.181, -.132, -.087, -.057,
2 -.056, -.061, -.066, -.071, -.077, -.107, -.127, -.132,
3  .253,  .265,  .282,  .291,  .305,  .312,  .320,  .328,  .336,
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3  .328,  .286,  .216,  .134,  .059,  .055,  .097,  .150,  .176,
3  .166,  .152,  .139,  .125,  .112,  .042, -.003, -.028,
4  .461,  .487,  .512,  .529,  .552,  .563,  .574,  .580,  .575,
4  .526,  .449,  .372,  .303,  .256,  .260,  .306,  .355,  .378,
4  .368,  .349,  .330,  .311,  .291,  .195,  .131,  .086/
 DATA((CL309(I,J),J=1,26),I=5,7)/
5  .615,  .659,  .700,  .721,  .746,  .765,  .776,  .761,  .724,
5  .665,  .602,  .539,  .475,  .429,  .434,  .474,  .527,  .542,
5  .529,  .511,  .488,  .466,  .443,  .331,  .253,  .201,
6  .758,  .815,  .861,  .893,  .930,  .942,  .926,  .892,  .837,
6  .781,  .726,  .670,  .618,  .581,  .596,  .639,  .681,  .699,
6  .683,  .658,  .633,  .608,  .583,  .459,  .366,  .296,
7  .907,  .956, 1.012, 1.048, 1.040, 1.016,  .979,  .933,  .888,
7  .843,  .797,  .752,  .708,  .670,  .679,  .718,  .758,  .772,
7  .757,  .737,  .716,  .696,  .675,  .553,  .472,  .407/
 DATA((CL312(I,J),J=1,26),I=1,4)/
1 -.109, -.115, -.130, -.142, -.156, -.163, -.173, -.182, -.204,
1 -.240, -.280, -.328, -.394, -.412, -.386, -.285, -.211, -.187,
1 -.191, -.200, -.209, -.218, -.226, -.262, -.275, -.273,
2  .057,  .061,  .071,  .079,  .088,  .093,  .103,  .112,  .096,
2  .036, -.033, -.116, -.207, -.233, -.203, -.143, -.080, -.058,
2 -.066, -.076, -.085, -.093, -.102, -.141, -.153, -.155,
3  .214,  .227,  .242,  .250,  .261,  .266,  .272,  .279,  .282,
3  .232,  .143,  .054, -.031, -.059, -.036,  .034,  .094,  .114,
3  .098,  .082,  .069,  .057,  .045, -.008, -.027, -.041,
4  .410,  .426,  .442,  .452,  .465,  .476,  .488,  .479,  .424,
4  .355,  .287,  .218,  .154,  .127,  .151,  .213,  .276,  .305,
4  .291,  .267,  .245,  .229,  .212,  .140,  .093,  .073/
 DATA((CL312(I,J),J=1,26),I=5,7)/
5  .553,  .585,  .613,  .632,  .654,  .669,  .649,  .593,  .538,
5  .483,  .423,  .361,  .299,  .274,  .305,  .364,  .423,  .449,
5  .434,  .414,  .394,  .375,  .360,  .278,  .219,  .184,
6  .687,  .738,  .780,  .810,  .842,  .856,  .833,  .775,  .717,
6  .649,  .578,  .507,  .441,  .414,  .444,  .499,  .559,  .585,
6  .575,  .554,  .533,  .511,  .490,  .403,  .337,  .295,
7  .828,  .871,  .903,  .928,  .968,  .945,  .895,  .838,  .772,
7  .707,  .641,  .575,  .513,  .489,  .518,  .569,  .635,  .655,
7  .640,  .625,  .610,  .596,  .582,  .505,  .448,  .406/
 DATA((CL315(I,J),J=1,26),I=1,4)/
1 -.124, -.119, -.119, -.121, -.122, -.123, -.124, -.137, -.212,
1 -.287, -.362, -.435, -.458, -.435, -.352, -.250, -.194, -.191,
1 -.190, -.190, -.190, -.190, -.190, -.197, -.213, -.226,
2  .023,  .026,  .033,  .037,  .042,  .044,  .046,  .043,  .007,
2 -.083, -.180, -.276, -.303, -.264, -.192, -.125, -.099, -.100,
2 -.101, -.103, -.104, -.106, -.107, -.116, -.119, -.121,
3  .197,  .194,  .198,  .202,  .211,  .215,  .217,  .200,  .144,
3  .055, -.042, -.135, -.180, -.145, -.070,  .003,  .028,  .027,
3  .023,  .020,  .016,  .012,  .009, -.009, -.022, -.023,
4  .374,  .386,  .401,  .410,  .422,  .430,  .425,  .398,  .329,
4  .251,  .153,  .058,  .017,  .052,  .130,  .205,  .231,  .222,
4  .214,  .206,  .199,  .192,  .185,  .147,  .116,  .092/
 DATA((CL315(I,J),J=1,26),I=5,7)/
5  .515,  .538,  .562,  .583,  .605,  .604,  .576,  .525,  .464,
5  .381,  .285,  .196,  .169,  .210,  .285,  .356,  .380,  .374,
5  .364,  .355,  .345,  .336,  .326,  .274,  .229,  .197,
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6  .633,  .661,  .695,  .725,  .758,  .753,  .714,  .661,  .569,
6  .478,  .387,  .285,  .263,  .304,  .372,  .430,  .453,  .450,
6  .441,  .433,  .424,  .416,  .408,  .365,  .328,  .292,
7  .742,  .777,  .813,  .842,  .874,  .857,  .802,  .730,  .641,
7  .553,  .464,  .353,  .319,  .357,  .432,  .503,  .530,  .525,
7  .519,  .512,  .506,  .499,  .492,  .452,  .422,  .393/
 DATA((CL318(I,J),J=1,26),I=1,4)/
1 -.157, -.175, -.196, -.213, -.236, -.269, -.319, -.388, -.457,
1 -.527, -.599, -.650, -.631, -.555, -.473, -.385, -.371, -.379,
1 -.386, -.394, -.402, -.408, -.410, -.412, -.411, -.410,
2 -.007, -.011, -.014, -.015, -.023, -.052, -.096, -.153, -.227,
2 -.313, -.404, -.492, -.473, -.347, -.239, -.204, -.210, -.215,
2 -.221, -.227, -.229, -.232, -.235, -.244, -.248, -.256,
3  .148,  .155,  .161,  .167,  .173,  .155,  .104,  .017, -.072,
3 -.161, -.243, -.288, -.243, -.140, -.048, -.004, -.006, -.009,
3 -.013, -.016, -.020, -.023, -.027, -.042, -.053, -.063,
4  .318,  .331,  .337,  .339,  .341,  .305,  .248,  .162,  .076,
4 -.010, -.079, -.109, -.070,  .033,  .123,  .147,  .144,  .140,
4  .135,  .130,  .125,  .119,  .114,  .086,  .066,  .048/
 DATA((CL318(I,J),J=1,26),I=5,7)/
5  .456,  .470,  .486,  .494,  .485,  .443,  .382,  .310,  .225,
5  .140,  .069,  .039,  .096,  .188,  .263,  .294,  .289,  .283,
5  .274,  .264,  .254,  .246,  .239,  .201,  .170,  .143,
6  .552,  .598,  .637,  .656,  .642,  .589,  .508,  .427,  .347,
6  .262,  .165,  .150,  .195,  .295,  .381,  .400,  .395,  .387,
6  .379,  .371,  .363,  .355,  .347,  .301,  .264,  .232,
7  .653,  .706,  .753,  .782,  .744,  .661,  .572,  .483,  .394,
7  .305,  .204,  .179,  .235,  .337,  .416,  .433,  .429,  .419,
7  .409,  .400,  .392,  .383,  .376,  .339,  .303,  .271/
 DATA((CL321(I,J),J=1,26),I=1,4)/
1 -.239, -.242, -.237, -.232, -.226, -.236, -.264, -.323, -.389,
1 -.454, -.480, -.457, -.378, -.298, -.243, -.243, -.245, -.247,
1 -.249, -.252, -.254, -.256, -.258, -.272, -.285, -.295,
2 -.065, -.063, -.062, -.052, -.046, -.053, -.091, -.175, -.259,
2 -.333, -.360, -.332, -.269, -.166, -.082, -.082, -.085, -.087,
2 -.090, -.092, -.095, -.097, -.100, -.116, -.133, -.151,
3  .095,  .095,  .098,  .105,  .117,  .113,  .093,  .012, -.102,
3 -.216, -.264, -.242, -.161, -.035,  .020,  .020,  .017,  .014,
3  .012,  .009,  .006,  .004,  .001, -.012, -.024, -.033,
4  .243,  .255,  .263,  .281,  .295,  .291,  .255,  .176,  .033,
4 -.110, -.162, -.149, -.070,  .071,  .124,  .122,  .117,  .111,
4  .106,  .100,  .095,  .089,  .084,  .062,  .044,  .026/
 DATA((CL321(I,J),J=1,26),I=5,7)/
5  .381,  .397,  .405,  .429,  .451,  .440,  .403,  .309,  .161,
5  .012, -.035, -.001,  .089,  .200,  .258,  .251,  .243,  .236,
5  .230,  .223,  .217,  .210,  .204,  .165,  .136,  .108,
6  .450,  .471,  .492,  .537,  .560,  .544,  .498,  .379,  .243,
6  .106,  .056,  .071,  .161,  .289,  .336,  .332,  .326,  .320,
6  .313,  .306,  .299,  .293,  .286,  .246,  .207,  .170,
7  .506,  .538,  .592,  .643,  .678,  .655,  .597,  .482,  .311,
7  .139,  .081,  .104,  .187,  .332,  .365,  .364,  .358,  .351,
7  .344,  .337,  .330,  .323,  .316,  .278,  .242,  .206/
 DATA((ALP304(J,N),N=1,9),J=1,13)/
& -5.83, -4.14, -2.44,  -.59,  1.20,  3.32,  5.65,  8.32, 11.05,
& -5.42, -3.92, -2.41,  -.73,  1.01,  2.95,  5.08,  7.60, 10.46,
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& -5.15, -3.78, -2.42,  -.86,   .83,  2.66,  4.67,  7.01,  9.88,
& -5.00, -3.71, -2.41,  -.93,   .71,  2.50,  4.40,  6.60,  9.48,
& -4.81, -3.61, -2.40, -1.00,   .58,  2.33,  4.06,  6.12,  8.86,
& -4.72, -3.56, -2.40, -1.04,   .52,  2.26,  3.92,  5.85,  8.76,
& -4.63, -3.52, -2.41, -1.08,   .44,  2.16,  3.75,  5.65,  8.76,
& -4.52, -3.47, -2.41, -1.12,   .37,  2.08,  3.60,  5.62,  8.73,
& -4.42, -3.41, -2.40, -1.17,   .27,  1.99,  3.49,  5.70,  8.77,
& -4.36, -3.38, -2.41, -1.21,   .19,  1.89,  3.43,  5.84,  8.98,
& -4.36, -3.40, -2.43, -1.27,   .08,  1.76,  3.45,  6.09,  9.12,
& -4.42, -3.44, -2.47, -1.33,  -.05,  1.64,  3.55,  6.35,  9.38,
& -4.57, -3.54, -2.52, -1.36,  -.05,  1.68,  3.72,  6.62,  9.69/
 DATA((ALP304(J,N),N=1,9),J=14,26)/
& -4.74, -3.66, -2.58, -1.32,   .17,  1.95,  4.04,  6.90, 10.05,
& -4.92, -3.76, -2.60, -1.20,   .48,  2.26,  4.41,  7.19, 10.37,
& -5.14, -3.83, -2.51,  -.94,   .78,  2.58,  4.74,  7.52, 10.64,
& -5.53, -3.88, -2.22,  -.59,  1.07,  2.86,  5.01,  7.83, 10.91,
& -5.83, -3.90, -1.98,  -.45,  1.18,  2.97,  5.14,  7.91, 10.85,
& -5.61, -3.90, -2.18,  -.58,  1.02,  2.74,  4.83,  7.61, 10.62,
& -5.35, -3.86, -2.37,  -.80,   .82,  2.52,  4.50,  7.21, 10.38,
& -5.13, -3.78, -2.44,  -.97,   .61,  2.30,  4.23,  6.75, 10.23,
& -4.97, -3.73, -2.48, -1.03,   .59,  2.29,  4.23,  6.83,  9.86,
& -4.89, -3.66, -2.43,  -.90,   .82,  2.64,  4.75,  7.45, 10.35,
& -4.98, -3.33, -1.60,   .55,  3.11,  5.89,  8.78, 11.68, 14.58,
& -5.19, -2.94,  -.39,  2.88,  6.11,  9.16, 12.21, 15.27, 18.32,
& -5.36, -2.77,   .44,  4.00,  7.72, 11.39, 15.06, 18.73, 22.40/
 DATA((ALP306(J,N),N=1,9),J=1,13)/
& -5.68, -4.12, -2.57,  -.75,  1.10,  3.29,  5.81,  8.64, 11.50,
& -5.75, -4.16, -2.57,  -.83,   .97,  2.97,  5.24,  7.96, 10.90,
& -5.75, -4.17, -2.59,  -.95,   .78,  2.63,  4.69,  7.20, 10.16,
& -5.81, -4.22, -2.62, -1.01,   .66,  2.44,  4.39,  6.71,  9.67,
& -5.84, -4.25, -2.67, -1.09,   .53,  2.26,  4.11,  6.21,  9.05,
& -5.85, -4.28, -2.70, -1.14,   .45,  2.17,  3.97,  5.99,  8.99,
& -5.89, -4.32, -2.75, -1.20,   .37,  2.09,  3.82,  5.96,  9.24,
& -5.95, -4.38, -2.80, -1.26,   .28,  2.01,  3.68,  6.18,  9.40,
& -5.99, -4.42, -2.85, -1.32,   .19,  1.85,  3.62,  6.62,  9.95,
& -6.02, -4.47, -2.92, -1.40,   .10,  1.71,  3.71,  7.09, 10.51,
& -6.07, -4.53, -2.99, -1.47,   .02,  1.64,  4.05,  7.60, 11.11,
& -6.13, -4.59, -3.05, -1.51,   .05,  1.92,  4.64,  8.13, 11.73,
& -6.40, -4.69, -2.98, -1.29,   .43,  2.44,  5.22,  8.64, 12.12/
 DATA((ALP306(J,N),N=1,9),J=14,26)/
& -6.02, -4.26, -2.49,  -.84,   .88,  2.94,  5.79,  9.14, 12.50,
& -5.27, -3.62, -1.98,  -.41,  1.32,  3.40,  6.34,  9.59, 12.85,
& -4.62, -3.07, -1.52,  -.01,  1.72,  3.79,  6.85,  9.91, 12.96,
& -4.18, -2.79, -1.35,   .16,  1.89,  3.94,  7.14, 10.32, 13.49,
& -4.38, -2.97, -1.52,  0.00,  1.62,  3.63,  6.82, 10.05, 13.27,
& -4.72, -3.27, -1.81,  -.29,  1.32,  3.27,  6.29,  9.46, 12.63,
& -5.07, -3.58, -2.09,  -.57,  1.02,  2.89,  5.76,  8.86, 11.94,
& -5.47, -3.83, -2.19,  -.70,   .92,  2.81,  5.40,  8.49, 11.54,
& -5.52, -3.80, -2.09,  -.60,  1.11,  3.07,  5.68,  8.80, 11.92,
& -5.47, -3.72, -1.98,  -.45,  1.39,  3.49,  6.26,  9.14, 12.01,
& -5.09, -3.16, -1.20,  1.10,  4.18,  6.64,  9.36, 12.08, 14.80,
& -4.83, -2.70,  -.26,  3.18,  6.06,  8.96, 11.86, 14.75, 17.65,
& -5.08, -2.81,   .28,  3.86,  7.64, 11.85, 16.06, 20.27, 24.48/
 DATA((ALP309(J,N),N=1,9),J=1,13)/
& -6.49, -4.53, -2.57,  -.54,  1.41,  3.81,  6.56,  9.25, 11.93,
```

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     & -6.44, -4.52, -2.60,  -.64,  1.22,  3.31,  5.81,  8.62, 11.46,
     & -6.62, -4.65, -2.68,  -.77,  1.03,  2.94,  5.24,  7.84, 10.49,
     & -6.73, -4.73, -2.73,  -.83,   .92,  2.74,  4.92,  7.38,  9.96,
     & -6.81, -4.80, -2.79,  -.93,   .77,  2.49,  4.59,  7.27, 10.91,
     & -6.87, -4.85, -2.83,  -.97,   .70,  2.37,  4.40,  7.57, 12.97,
     & -6.90, -4.88, -2.86, -1.02,   .63,  2.26,  4.32,  8.79, 16.34,
     & -6.94, -4.92, -2.90, -1.07,   .57,  2.22,  4.60, 11.27, 21.02,
     & -6.92, -4.94, -2.96, -1.14,   .54,  2.34,  5.35, 12.39, 20.24,
     & -7.08, -5.06, -3.04, -1.14,   .73,  3.06,  6.61, 13.06, 19.52,
     & -6.46, -4.57, -2.67,  -.80,  1.40,  3.97,  8.08, 13.72, 19.35,
     & -5.53, -3.71, -1.89,  -.14,  2.34,  4.93,  9.17, 14.05, 18.93,
     & -4.52, -2.77, -1.09,   .78,  3.13,  5.75, 10.04, 14.49, 18.93/
      DATA((ALP309(J,N),N=1,9),J=14,26)/
     & -3.86, -2.14,  -.49,  1.43,  3.66,  6.43, 10.92, 15.42, 19.91,
     & -3.86, -2.16,  -.47,  1.41,  3.61,  6.10, 10.92, 15.73, 20.55,
     & -4.12, -2.54,  -.85,   .99,  3.12,  5.53, 10.08, 15.14, 20.20,
     & -4.66, -2.96, -1.27,   .49,  2.52,  4.95,  9.09, 14.29, 19.48,
     & -5.09, -3.29, -1.51,   .24,  2.27,  4.74,  8.77, 14.25, 19.73,
     & -5.17, -3.33, -1.50,   .34,  2.40,  4.92,  9.16, 14.57, 19.97,
     & -5.18, -3.31, -1.43,   .49,  2.63,  5.21,  9.59, 14.66, 19.72,
     & -5.21, -3.29, -1.36,   .64,  2.89,  5.54, 10.02, 14.84, 19.66,
     & -5.23, -3.26, -1.28,   .81,  3.15,  5.89, 10.36, 14.91, 19.45,
     & -5.26, -3.24, -1.19,   .98,  3.43,  6.37, 10.72, 15.07, 19.41,
     & -5.33, -3.06,  -.56,  2.07,  5.08,  9.00, 13.26, 17.51, 21.77,
     & -5.41, -2.91,   .04,  3.13,  6.64, 10.42, 14.19, 17.96, 21.74,
     & -5.60, -2.91,   .49,  3.98,  7.87, 11.48, 15.08, 18.68, 22.29/
      DATA((ALP312(J,N),N=1,9),J=1,13)/
     & -7.51, -5.10, -2.69,  -.18,  1.90,  4.70,  7.60, 10.44, 13.28,
     & -7.24, -4.97, -2.69,  -.33,  1.74,  4.20,  6.93,  9.94, 12.95,
     & -6.69, -4.70, -2.71,  -.49,  1.58,  3.85,  6.33,  9.58, 12.83,
     & -6.33, -4.52, -2.71,  -.58,  1.49,  3.64,  5.89,  9.22, 12.61,
     & -6.00, -4.36, -2.72,  -.71,  1.36,  3.43,  5.55,  8.51, 11.68,
     & -5.85, -4.29, -2.73,  -.76,  1.28,  3.28,  5.40,  9.24, 13.73,
     & -5.64, -4.20, -2.75,  -.85,  1.19,  3.39,  5.64, 11.39, 17.84,
     & -5.48, -4.12, -2.76,  -.95,  1.21,  4.08,  6.79, 13.14, 19.49,
     & -5.31, -3.97, -2.64,  -.88,  1.66,  4.69,  9.02, 16.29, 23.56,
     & -5.16, -3.71, -2.26,  -.33,  2.70,  5.41, 11.21, 18.10, 25.00,
     & -4.97, -3.35, -1.63,   .79,  3.66,  6.70, 13.05, 19.40, 25.75,
     & -4.68, -2.79,  -.64,  1.78,  4.53,  8.74, 14.62, 20.50, 26.38,
     & -4.06, -1.92,   .34,  2.63,  5.42, 10.42, 15.97, 21.53, 27.08/
      DATA((ALP312(J,N),N=1,9),J=14,26)/
     & -3.87, -1.62,   .63,  2.99,  5.80, 10.96, 16.29, 21.63, 26.96,
     & -4.15, -1.96,   .39,  2.64,  5.37, 10.22, 15.62, 21.03, 26.43,
     & -5.62, -2.80,  -.38,  1.85,  4.53,  8.89, 14.60, 20.31, 26.03,
     & -6.89, -3.83, -1.08,  1.16,  3.69,  7.08, 12.34, 17.61, 22.87,
     & -7.30, -4.20, -1.33,   .90,  3.32,  6.43, 12.14, 17.86, 23.57,
     & -7.34, -4.14, -1.20,  1.06,  3.52,  6.77, 12.92, 19.08, 25.23,
     & -7.23, -4.00, -1.04,  1.28,  3.81,  7.30, 12.93, 18.56, 24.20,
     & -7.08, -3.85,  -.90,  1.49,  4.09,  7.74, 12.94, 18.13, 23.32,
     & -6.91, -3.71,  -.76,  1.66,  4.37,  8.09, 12.80, 17.51, 22.21,
     & -6.81, -3.58,  -.61,  1.86,  4.62,  8.39, 12.74, 17.09, 21.43,
     & -6.28, -2.98,   .11,  2.87,  5.95,  9.86, 13.78, 17.71, 21.63,
     & -6.05, -2.77,   .45,  3.70,  7.14, 10.74, 14.34, 17.95, 21.55,
     & -6.15, -2.76,   .72,  4.29,  7.89, 11.50, 15.10, 18.70, 22.31/
      DATA((ALP315(J,N),N=1,9),J=1,13)/
```

```
     & -7.76, -5.03, -2.31,   .03,  2.37,  5.44,  9.06, 12.73, 16.40,
     & -7.88, -5.12, -2.36,   .06,  2.18,  5.01,  8.40, 11.84, 15.29,
     & -7.70, -5.07, -2.43,   .02,  1.99,  4.57,  7.78, 11.17, 14.56,
     & -7.53, -5.00, -2.47,  -.02,  1.90,  4.24,  7.28, 10.70, 14.12,
     & -7.39, -4.95, -2.51,  -.13,  1.79,  3.95,  6.72, 10.17, 13.62,
     & -7.32, -4.92, -2.53,  -.18,  1.72,  3.95,  6.90, 10.75, 14.60,
     & -7.25, -4.89, -2.54,  -.20,  1.76,  4.35,  7.95, 12.50, 17.05,
     & -6.92, -4.70, -2.48,  0.00,  2.03,  5.10, 10.03, 15.83, 21.62,
     & -5.72, -3.89, -2.06,   .61,  3.05,  6.86, 12.42, 17.97, 23.53,
     & -5.11, -3.15,  -.80,  1.48,  4.39,  9.25, 14.59, 19.92, 25.25,
     & -4.42, -2.22,   .43,  2.71,  6.34, 11.53, 16.73, 21.92, 27.12,
     & -3.56,  -.92,  1.40,  4.09,  9.38, 15.26, 21.15, 27.03, 32.91,
     & -3.25,  -.33,  1.83,  4.66, 10.89, 18.04, 25.18, 32.32, 39.46/
      DATA((ALP315(J,N),N=1,9),J=14,26)/
     & -3.59,  -.92,  1.47,  3.87,  9.62, 17.17, 24.72, 32.26, 39.81,
     & -4.60, -2.10,   .70,  2.90,  6.93, 13.60, 20.27, 26.93, 33.60,
     & -6.40, -3.20,  -.05,  1.95,  5.19, 10.66, 16.14, 21.62, 27.10,
     & -8.34, -4.13,  -.44,  1.69,  4.55,  9.82, 15.01, 20.21, 25.40,
     & -8.59, -4.20,  -.43,  1.77,  4.68, 10.00, 15.33, 20.67, 26.00,
     & -8.72, -4.22,  -.37,  1.85,  4.94, 10.08, 15.21, 20.33, 25.46,
     & -8.83, -4.23,  -.33,  1.94,  5.15, 10.23, 15.29, 20.35, 25.42,
     & -8.88, -4.23,  -.27,  2.01,  5.39, 10.29, 15.17, 20.05, 24.93,
     & -9.00, -4.24,  -.20,  2.11,  5.60, 10.43, 15.25, 20.07, 24.89,
     & -9.06, -4.24,  -.16,  2.21,  5.80, 10.57, 15.33, 20.10, 24.86,
     & -9.01, -4.07,   .12,  2.83,  6.80, 11.40, 16.00, 20.60, 25.20,
     & -7.98, -3.72,   .32,  3.49,  7.53, 11.79, 16.04, 20.30, 24.55,
     & -7.31, -3.50,   .40,  4.06,  8.14, 12.10, 16.06, 20.02, 23.98/
      DATA((ALP318(J,N),N=1,9),J=1,13)/
     & -7.24, -4.57, -1.91,   .61,  3.19,  6.95, 10.91, 14.87, 18.83,
     & -6.74, -4.30, -1.87,   .51,  2.99,  6.04,  9.74, 13.44, 17.15,
     & -6.24, -4.04, -1.84,   .44,  2.85,  5.51,  8.81, 12.26, 15.71,
     & -5.89, -3.87, -1.84,   .38,  2.79,  5.31,  8.29, 11.46, 14.63,
     & -5.54, -3.66, -1.77,   .32,  2.82,  5.46,  9.10, 13.02, 16.94,
     & -5.21, -3.36, -1.50,   .60,  3.38,  6.31, 11.86, 17.42, 22.97,
     & -4.73, -2.93, -1.04,  1.33,  4.29,  8.88, 15.13, 21.38, 27.63,
     & -4.10, -2.40,  -.20,  2.51,  5.54, 12.18, 19.32, 26.46, 33.61,
     & -3.50, -1.65,   .97,  3.66,  8.26, 16.77, 25.28, 33.79, 42.30,
     & -2.81,  -.51,  2.13,  4.98, 12.42, 21.72, 31.02, 40.33, 49.63,
     & -1.95,   .52,  3.07,  7.79, 18.05, 28.31, 38.56, 48.82, 59.08,
     & -1.10,   .98,  3.47,  9.45, 23.24, 37.03, 50.83, 64.62, 78.41,
     & -1.37,   .50,  2.84,  6.25, 16.25, 26.25, 36.25, 46.25, 56.25/
      DATA((ALP318(J,N),N=1,9),J=14,26)/
     & -2.51,  -.58,  1.62,  4.22, 11.00, 20.52, 30.05, 39.57, 49.10,
     & -3.38, -1.59,   .56,  3.10,  7.09, 18.51, 29.94, 41.37, 52.80,
     & -4.17, -1.96,   .05,  2.72,  6.00, 18.12, 30.24, 42.36, 54.48,
     & -4.36, -1.90,   .08,  2.77,  6.29, 18.06, 29.82, 41.59, 53.35,
     & -4.26, -1.85,   .12,  2.84,  6.81, 19.31, 31.81, 44.31, 56.81,
     & -4.17, -1.80,   .18,  2.94,  7.40, 20.73, 34.07, 47.40, 60.73,
     & -4.07, -1.74,   .22,  3.04,  8.00, 21.79, 35.59, 49.38, 63.17,
     & -3.98, -1.72,   .28,  3.16,  8.55, 22.34, 36.14, 49.93, 63.72,
     & -3.91, -1.69,   .32,  3.28,  9.21, 23.50, 37.79, 52.07, 66.36,
     & -3.89, -1.66,   .38,  3.38,  9.66, 23.45, 37.24, 51.03, 64.83,
     & -3.86, -1.56,   .66,  3.98, 11.21, 21.74, 32.26, 42.79, 53.32,
     & -3.87, -1.51,   .89,  4.64, 12.97, 23.23, 33.49, 43.74, 54.00,
     & -3.87, -1.42,  1.14,  5.28, 14.62, 24.87, 35.13, 45.38, 55.64/
```

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 DATA((ALP321(J,N),N=1,9),J=1,13)/
& -5.85, -3.55, -1.19,  1.42,  4.55, 11.36, 18.50, 25.64, 32.79,
& -5.77, -3.53, -1.20,  1.31,  4.08,  9.85, 15.82, 21.79, 27.76,
& -5.86, -3.58, -1.23,  1.24,  3.93,  8.16, 12.16, 16.16, 20.16,
& -5.87, -3.64, -1.34,  1.08,  3.61,  7.19, 10.96, 14.74, 18.51,
& -5.93, -3.71, -1.44,   .93,  3.35,  6.68, 10.07, 13.46, 16.85,
& -5.79, -3.61, -1.36,   .98,  3.46,  7.01, 10.61, 14.22, 17.82,
& -5.57, -3.26, -1.01,  1.32,  3.96,  8.06, 12.10, 16.14, 20.18,
& -5.04, -2.34,  -.13,  2.36,  6.41, 10.29, 14.17, 18.06, 21.94,
& -4.17, -1.25,  1.51,  4.95, 10.62, 16.50, 22.38, 28.26, 34.15,
& -3.11,   .30,  3.80, 11.70, 23.82, 35.94, 48.06, 60.18, 72.30,
& -2.67,  1.25,  4.77, 17.52, 33.52, 49.52, 65.52, 81.52, 97.52,
& -3.09,   .90,  4.03, 13.82, 25.94, 38.06, 50.18, 62.30, 74.42,
& -4.40,  -.72,  2.88,  9.00, 24.38, 39.77, 55.15, 70.54, 85.92/
 DATA((ALP321(J,N),N=1,9),J=14,26)/
& -5.55, -2.52,   .66,  4.00, 11.16, 20.47, 29.77, 39.07, 48.37,
& -5.95, -3.47,  -.39,  3.13, 10.41, 24.21, 38.00, 51.79, 65.59,
& -5.95, -3.47,  -.39,  3.21, 10.25, 22.75, 35.25, 47.75, 60.25,
& -5.94, -3.44,  -.33,  3.32, 10.63, 23.13, 35.63, 48.13, 60.63,
& -5.91, -3.41,  -.28,  3.42, 11.16, 24.06, 36.97, 49.87, 62.77,
& -5.90, -3.38,  -.24,  3.52, 11.61, 24.52, 37.42, 50.32, 63.23,
& -5.85, -3.35,  -.18,  3.63, 12.06, 24.97, 37.87, 50.77, 63.68,
& -5.84, -3.32,  -.12,  3.72, 12.52, 25.42, 38.32, 51.23, 64.13,
& -5.81, -3.30,  -.08,  3.83, 13.13, 26.47, 39.80, 53.13, 66.47,
& -5.80, -3.27,  -.02,  3.93, 13.60, 26.93, 40.27, 53.60, 66.93,
& -5.64, -3.08,   .32,  4.86, 15.63, 28.13, 40.63, 53.13, 65.63,
& -5.51, -2.88,   .71,  5.80, 17.03, 28.46, 39.89, 51.31, 62.74,
& -5.46, -2.68,  1.12,  7.67, 18.78, 29.89, 41.00, 52.11, 63.22/
 DATA((CD304(I,J),J=1,26),I=1,5)/
1 .0095, .0093, .0092, .0092, .0091, .0091, .0091, .0091, .0091,
1 .0094, .0096, .0102, .0115, .0147, .0192, .0237, .0273, .0295,
1 .0318, .0332, .0345, .0357, .0365, .0319, .0240, .0193,
2 .0049, .0049, .0049, .0049, .0049, .0049, .0049, .0049, .0049,
2 .0049, .0049, .0054, .0080, .0120, .0167, .0207, .0237, .0265,
2 .0290, .0311, .0324, .0333, .0337, .0339, .0314, .0284,
3 .0049, .0049, .0049, .0049, .0049, .0049, .0049, .0049, .0049,
3 .0049, .0049, .0059, .0094, .0152, .0213, .0263, .0292, .0317,
3 .0336, .0354, .0367, .0380, .0393, .0469, .0549, .0629,
4 .0084, .0083, .0083, .0080, .0075, .0074, .0073, .0073, .0075,
4 .0078, .0085, .0121, .0176, .0237, .0309, .0383, .0459, .0532,
4 .0597, .0662, .0713, .0758, .0802, .0974, .1106, .1227,
5 .0435, .0220, .0150, .0133, .0121, .0116, .0116, .0118, .0124,
5 .0151, .0212, .0282, .0369, .0478, .0598, .0724, .0837, .0947,
5 .1046, .1130, .1215, .1292, .1349, .1574, .1728, .1843/
 DATA((CD306(I,J),J=1,26),I=1,5)/
1 .0095, .0094, .0094, .0093, .0093, .0093, .0093, .0093, .0092,
1 .0092, .0096, .0108, .0159, .0218, .0277, .0336, .0390, .0431,
1 .0465, .0478, .0488, .0488, .0482, .0424, .0353, .0280,
2 .0044, .0045, .0045, .0045, .0045, .0045, .0045, .0045, .0045,
2 .0050, .0060, .0092, .0136, .0179, .0222, .0270, .0319, .0350,
2 .0378, .0407, .0420, .0426, .0432, .0433, .0397, .0350,
3 .0046, .0046, .0046, .0046, .0046, .0046, .0046, .0046, .0051,
3 .0058, .0097, .0138, .0180, .0221, .0262, .0308, .0361, .0398,
3 .0428, .0457, .0472, .0487, .0501, .0579, .0648, .0705,
4 .0073, .0073, .0073, .0072, .0067, .0065, .0065, .0067, .0076,
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4 .0110, .0171, .0231, .0292, .0353, .0414, .0478, .0559, .0641,
4 .0706, .0760, .0815, .0869, .0909, .1080, .1109, .1142,
5 .0292, .0207, .0161, .0144, .0137, .0134, .0139, .0145, .0166,
5 .0192, .0280, .0408, .0536, .0664, .0799, .0991, .1170, .1271,
5 .1373, .1472, .1555, .1639, .1722, .2071, .2243, .2266/
 DATA((CD309(I,J),J=1,26),I=1,5)/
1 .0094, .0093, .0092, .0092, .0092, .0092, .0092, .0092, .0092,
1 .0099, .0129, .0171, .0217, .0274, .0331, .0387, .0447, .0509,
1 .0569, .0617, .0663, .0693, .0696, .0636, .0569, .0498,
2 .0059, .0059, .0059, .0058, .0058, .0059, .0059, .0061, .0065,
2 .0078, .0113, .0155, .0202, .0249, .0307, .0365, .0422, .0482,
2 .0542, .0601, .0640, .0680, .0707, .0691, .0642, .0583,
3 .0059, .0058, .0057, .0058, .0058, .0059, .0060, .0064, .0068,
3 .0083, .0121, .0175, .0234, .0299, .0367, .0442, .0516, .0582,
3 .0647, .0688, .0729, .0770, .0786, .0857, .0890, .0915,
4 .0114, .0094, .0080, .0076, .0077, .0079, .0083, .0091, .0114,
4 .0137, .0183, .0241, .0350, .0460, .0576, .0698, .0816, .0897,
4 .0977, .1058, .1100, .1142, .1185, .1300, .1353, .1353,
5 .0230, .0172, .0142, .0133, .0128, .0133, .0143, .0181, .0218,
5 .0273, .0361, .0473, .0620, .0773, .0934, .1089, .1222, .1354,
5 .1462, .1550, .1637, .1683, .1699, .1772, .1835, .1894/
 DATA((CD312(I,J),J=1,26),I=1,5)/
1 .0099, .0099, .0098, .0098, .0098, .0098, .0097, .0097, .0098,
1 .0114, .0182, .0261, .0352, .0448, .0547, .0649, .0746, .0829,
1 .0908, .0955, .1001, .1011, .1009, .0973, .0872, .0736,
2 .0061, .0060, .0060, .0060, .0060, .0060, .0060, .0060, .0066,
2 .0095, .0156, .0235, .0327, .0429, .0526, .0619, .0707, .0784,
2 .0851, .0919, .0968, .1013, .1046, .0996, .0906, .0793,
3 .0061, .0061, .0061, .0060, .0060, .0060, .0061, .0073, .0098,
3 .0144, .0200, .0284, .0375, .0473, .0573, .0672, .0766, .0857,
3 .0936, .0996, .1057, .1098, .1135, .1135, .1110, .1082,
4 .0125, .0106, .0096, .0097, .0100, .0101, .0104, .0117, .0168,
4 .0226, .0320, .0423, .0525, .0647, .0780, .0903, .1011, .1109,
4 .1193, .1278, .1349, .1410, .1471, .1646, .1718, .1749,
5 .0204, .0180, .0169, .0168, .0168, .0170, .0185, .0242, .0365,
5 .0528, .0724, .0906, .1070, .1213, .1351, .1487, .1622, .1753,
5 .1879, .2004, .2130, .2226, .2309, .2661, .2646, .2631/
 DATA((CD315(I,J),J=1,26),I=1,5)/
1 .0084, .0088, .0089, .0090, .0091, .0091, .0091, .0094, .0116,
1 .0206, .0319, .0438, .0563, .0688, .0803, .0912, .1016, .1117,
1 .1209, .1292, .1353, .1397, .1437, .1382, .1223, .1063,
2 .0078, .0078, .0078, .0078, .0082, .0086, .0093, .0104, .0141,
2 .0234, .0346, .0458, .0577, .0696, .0800, .0903, .0992, .1082,
2 .1172, .1234, .1291, .1348, .1390, .1393, .1330, .1236,
3 .0091, .0082, .0082, .0083, .0089, .0092, .0099, .0115, .0173,
3 .0276, .0394, .0511, .0630, .0749, .0853, .0953, .1053, .1152,
3 .1240, .1310, .1381, .1451, .1470, .1518, .1521, .1521,
4 .0090, .0115, .0128, .0134, .0140, .0149, .0169, .0204, .0275,
4 .0422, .0581, .0717, .0835, .0962, .1092, .1218, .1341, .1444,
4 .1533, .1623, .1688, .1743, .1799, .1975, .2035, .2095,
5 .0235, .0206, .0203, .0207, .0215, .0228, .0262, .0384, .0564,
5 .0782, .0993, .1199, .1383, .1548, .1699, .1836, .1974, .2101,
5 .2215, .2330, .2425, .2491, .2556, .2677, .2715, .2753/
 DATA((CD318(I,J),J=1,26),I=1,5)/
1 .0106, .0136, .0151, .0158, .0166, .0169, .0173, .0186, .0228,
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1 .0337, .0486, .0633, .0765, .0887, .1008, .1129, .1203, .1272,
1 .1340, .1401, .1448, .1495, .1520, .1519, .1490, .1449,
2 .0082, .0081, .0080, .0080, .0081, .0083, .0090, .0148, .0267,
2 .0386, .0516, .0693, .0851, .0994, .1112, .1228, .1316, .1367,
2 .1418, .1468, .1503, .1537, .1571, .1606, .1577, .1533,
3 .0096, .0096, .0097, .0097, .0097, .0102, .0117, .0195, .0313,
3 .0431, .0579, .0752, .0912, .1049, .1184, .1263, .1341, .1420,
3 .1498, .1563, .1617, .1670, .1723, .1752, .1765, .1779,
4 .0169, .0176, .0179, .0180, .0191, .0205, .0261, .0411, .0562,
4 .0713, .0877, .1044, .1181, .1305, .1430, .1554, .1663, .1735,
4 .1807, .1879, .1950, .2007, .2058, .2196, .2280, .2365,
5 .0282, .0331, .0355, .0367, .0392, .0419, .0489, .0651, .0887,
5 .1122, .1365, .1619, .1860, .2085, .2298, .2470, .2642, .2767,
5 .2863, .2959, .3022, .3083, .3118, .3252, .3386, .3520/
 DATA((CD321(I,J),J=1,26),I=1,5)/
1 .0119, .0126, .0125, .0128, .0133, .0148, .0178, .0269,
1 .0411, .0565, .0721, .0879, .1038, .1179, .1304, .1428, .1545,
1 .1618, .1691, .1764, .1822, .1836, .1886, .1894, .1903,
2 .0095, .0094, .0094, .0094, .0094, .0101, .0121, .0221, .0320,
2 .0454, .0601, .0781, .0965, .1123, .1251, .1378, .1505, .1622,
2 .1700, .1779, .1857, .1936, .1956, .2014, .2014, .2014,
3 .0111, .0113, .0113, .0114, .0114, .0120, .0174, .0273, .0383,
3 .0542, .0703, .0874, .1044, .1191, .1322, .1452, .1583, .1713,
3 .1843, .1961, .2030, .2099, .2168, .2207, .2219, .2231,
4 .0269, .0213, .0208, .0211, .0231, .0264, .0368, .0533, .0705,
4 .0878, .1046, .1214, .1382, .1534, .1686, .1838, .1990, .2098,
4 .2186, .2274, .2362, .2450, .2538, .2649, .2663, .2676,
5 .0439, .0387, .0388, .0400, .0448, .0549, .0735, .0921, .1132,
5 .1344, .1548, .1750, .1969, .2210, .2450, .2664, .2843, .3022,
5 .3068, .3069, .3071, .3072, .3074, .3083, .3092, .3102/
 DATA(XMI(J),J=1,26)/.3,.5,.6,.65,.7,.725,.75,.775,
& .8,.825,.85,.875,.9,.925,.95,.975,1.0,1.025,1.05,1.075,
&1.1,1.125,1.15,1.3,1.45,1.6/
 DATA(CLI(J),J=1,9)/-.4,-.2,0.0,.2,.4,.6,.8,1.0,1.2/
 DATA(ALPI(J),J=1,7)/-4.0,-2.0,0.0,2.0,4.0,6.0,8.0/
 DATA(CLII(J),J=1,5)/0.0,.2,.4,.6,.8/
 IORDER(1)=IORDER(2)=1
 IPT (1) = -1
 IF (IKEY .EQ. 2) GO TO 1000
 IF (TR .LT. .04) GO TO 9
 IF (TR .GE. .04 .AND. TR .LT. .06) GO TO 1
 IF (TR .GE. .06 .AND. TR .LT. .09) GO TO 2
 IF (TR .GE. .09 .AND. TR .LT. .12) GO TO 3
 IF (TR .GE. .12 .AND. TR .LT. .15) GO TO 4
 IF (TR .GE. .15 .AND. TR .LT. .18) GO TO 5
 IF (TR .GE. .18 .AND. TR .LT. .21) GO TO 6
 IF (TR .GE. .21) GO TO 7
9 CALL IBI (7,ALPI,26,XMI,7,CL304,IORDER,IPT,AA,XM,CLFT04,IERR)
 CL=CLFT04
 GO TO 400
1 CALL IBI (7,ALPI,26,XMI,7,CL304,IORDER,IPT,AA,XM,CLFT04,IERR)
 IPT (1)=-1
 CALL IBI (7,ALPI,26,XMI,7,CL306,IORDER,IPT,AA,XM,CLFT06,IERR)
 CL=CLFT04 + (CLFT06-CLFT04)*((TR-.04)/(.06-.04))
 GO TO 400
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    2 CALL IBI (7,ALPI,26,XMI,7,CL306,IORDER,IPT,AA,XM,CLFT06,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL309,IORDER,IPT,AA,XM,CLFT09,IERR)
      CL=CLFT06 + (CLFT09 - CLFT06)*((TR-.06)/(.09-.06))
      GO TO 400
    3 CALL IBI (7,ALPI,26,XMI,7,CL309,IORDER,IPT,AA,XM,CLFT09,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL312,IORDER,IPT,AA,XM,CLFT12,IERR)
      CL=CLFT09+(CLFT12-CLFT09)*((TR-.09)/(.12-.09))
      GO TO 400
    4 CALL IBI (7,ALPI,26,XMI,7,CL312,IORDER,IPT,AA,XM,CLFT12,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL315,IORDER,IPT,AA,XM,CLFT15,IERR)
      CL=CLFT12 + (CLFT15-CLFT12)*((TR-.12)/(.15-.12))
      GO TO 400
    5 CALL IBI (7,ALPI,26,XMI,7,CL315,IORDER,IPT,AA,XM,CLFT15,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL318,IORDER,IPT,AA,XM,CLFT18,IERR)
      CL=CLFT15+(CLFT18-CLFT15)*((TR-.15)/(.18-.15))
      GO TO 400
    6 CALL IBI (7,ALPI,26,XMI,7,CL318,IORDER,IPT,AA,XM,CLFT18,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL321,IORDER,IPT,AA,XM,CLFT21,IERR)
      CL=CLFT18+(CLFT21-CLFT18)*((TR-.18)/(.21-.18))
      GO TO 400
    7 CALL IBI (7,ALPI,26,XMI,7,CL321,IORDER,IPT,AA,XM,CLFT21,IERR)
      CL=CLFT21
      GO TO 400
 1000 CONTINUE
      IPT (1)=-1
      IF (TR .LT. .04) GO TO 90
      IF (TR .GE. .04 .AND. TR .LT. .06) GO TO 10
      IF (TR .GE. .06 .AND. TR .LT. .09) GO TO 20
      IF (TR .GE. .09 .AND. TR .LT. .12) GO TO 30
      IF (TR .GE. .12 .AND. TR .LT. .15) GO TO 40
      IF (TR .GE. .15 .AND. TR .LT. .18) GO TO 50
      IF (TR .GE. .18 .AND. TR .LT. .21) GO TO 60
      IF (TR .GE. .21) GO TO 70
     90 CALL IBI (26,XMI,9,CLI,26,ALP304,IORDER,IPT,XM,CL,AA04,IERR)
      AA=AA04
      GO TO 400
     10 CALL IBI (26,XMI,9,CLI,26,ALP304,IORDER,IPT,XM,CL,AA04,IERR)
      IPT (1) = -1
      CALL IBI (26,XMI,9,CLI,26,ALP306,IORDER,IPT,XM,CL,AA06,IERR)
      AA=AA04 + (AA06-AA04)*((TR-.04)/(.06-.04))
      GO TO 400
     20 CALL IBI (26,XMI,9,CLI,26,ALP306,IORDER,IPT,XM,CL,AA06,IERR)
      IPT (1) = -1
      CALL IBI (26,XMI,9,CLI,26,ALP309,IORDER,IPT,XM,CL,AA09,IERR)
      AA=AA06 + (AA09 - AA06)*((TR -.06)/(.09-.06))
      GO TO 400
     30 CALL IBI (26,XMI,9,CLI,26,ALP309,IORDER,IPT,XM,CL,AA09,IERR)
      IPT (1) = -1
      CALL IBI (26,XMI,9,CLI,26,ALP312,IORDER,IPT,XM,CL,AA12,IERR)
      AA=AA09+(AA12-AA09)*((TR-.09)/(.12-.09))
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      GO TO 400
 40   CALL IBI (26,XMI,9,CLI,26,ALP312,IORDER,IPT,XM,CL,AA12,IERR)
      IPT (1) = -1
      CALL IBI (26,XMI,9,CLI,26,ALP315,IORDER,IPT,XM,CL,AA15,IERR)
      AA=AA12+(AA15-AA12)*((TR-.12)/(.15-.12))
      GO TO 400
 50   CALL IBI (26,XMI,9,CLI,26,ALP315,IORDER,IPT,XM,CL,AA15,IERR)
      IPT (1) = -1
      CALL IBI (26,XMI,9,CLI,26,ALP318,IORDER,IPT,XM,CL,AA18,IERR)
      AA=AA15+(AA18-AA15)*((TR-.15)/(.18-.15))
      GO TO 400
 60   CALL IBI (26,XMI,9,CLI,26,ALP318,IORDER,IPT,XM,CL,AA18,IERR)
      IPT (1) = -1
      CALL IBI (26,XMI,9,CLI,26,ALP321,IORDER,IPT,XM,CL,AA21,IERR)
      AA=AA18+(AA21-AA18)*((TR-.18)/(.21-.18))
      GO TO 400
 70   CALL IBI (26,XMI,9,CLI,26,ALP321,IORDER,IPT,XM,CL,AA21,IERR)
      AA=AA21
400   CONTINUE
      IPT (1)=-1
      IF (TR .LT. .04) GO TO 91
      IF (TR .GE. .04 .AND. TR .LT. .06) GO TO 11
      IF (TR .GE. .06 .AND. TR .LT. .09) GO TO 21
      IF (TR .GE. .09 .AND. TR .LT. .12) GO TO 31
      IF (TR .GE. .12 .AND. TR .LT. .15) GO TO 41
      IF (TR .GE. .15 .AND. TR .LT. .18) GO TO 51
      IF (TR .GE. .18 .AND. TR .LT. .21) GO TO 61
      IF (TR .GE. .21) GO TO 71
 91   CALL IBI (5,CLII,26,XMI,5,CD304,IORDER,IPT,CL,XM,CDRG04,IERR)
      CD=CDRG04
      WRITE (6,201) TR
201   FORMAT(*0THICKNESS RATIO=*,F5.3,* IS OUT OF RANGE.
     &*/* THE VALUES FOR T/C=.04 HAVE BEEN RETURNED*)
      GO TO 250
 11   CALL IBI (5,CLII,26,XMI,5,CD304,IORDER,IPT,CL,XM,CDRG04,IERR)
      IPT (1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD306,IORDER,IPT,CL,XM,CDRG06,IERR)
      CD=CDRG04 + (CDRG06-CDRG04)*((TR-.04)/(.06-.04))
      GO TO 250
 21   CALL IBI (5,CLII,26,XMI,5,CD306,IORDER,IPT,CL,XM,CDRG06,IERR)
      IPT (1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD309,IORDER,IPT,CL,XM,CDRG09,IERR)
      CD=CDRG06 + (CDRG09 - CDRG06)*((TR-.06)/(.09-.06))
      GO TO 250
 31   CALL IBI (5,CLII,26,XMI,5,CD309,IORDER,IPT,CL,XM,CDRG09,IERR)
      IPT (1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD312,IORDER,IPT,CL,XM,CDRG12,IERR)
      CD=CDRG09+(CDRG12-CDRG09)*((TR-.09)/(.12-.09))
      GO TO 250
 41   CALL IBI (5,CLII,26,XMI,5,CD312,IORDER,IPT,CL,XM,CDRG12,IERR)
      IPT (1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD315,IORDER,IPT,CL,XM,CDRG15,IERR)
      CD=CDRG12 + (CDRG15-CDRG12)*((TR-.12)/(.15-.12))
      GO TO 250
 51   CALL IBI (5,CLII,26,XMI,5,CD315,IORDER,IPT,CL,XM,CDRG15,IERR)
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      IPT (1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD318,IORDER,IPT,CL,XM,CDRG18,IERR)
      CD=CDRG15+(CDRG18-CDRG15)*((TR-.15)/(.18-.15))
      GO TO 250
   61 CALL IBI (5,CLII,26,XMI,5,CD318,IORDER,IPT,CL,XM,CDRG18,IERR)
      IPT (1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD321,IORDER,IPT,CL,XM,CDRG21,IERR)
      CD=CDRG18+(CDRG21-CDRG18)*((TR-.18)/(.21-.18))
      GO TO 250
   71 CALL IBI (5,CLII,26,XMI,5,CD321,IORDER,IPT,CL,XM,CDRG21,IERR)
      CD=CDRG21
      IF (TR .GT. .21) WRITE(6,204) TR
  204  FORMAT(*0THICKNESS RATIO=*,F5.3,* IS OUT OF RANGE.
     &*/* THE VALUES FOR T/C=.21 HAVE BEEN RETURNED.*)
  250 IF(CL .GT. .8) GO TO 251
      RETURN
  251 CALL COMPUT(D,XM,ALT,COR,TR,AA,CDT,CL,CD,CLDES)
      CD=CDT
      RETURN
      END


      SUBROUTINE AERO4(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
C
C
C THIS SUBROUTINE IS DESIGNED TO COMPUTE THE AIRFOIL
C CHARACTERISTICS FOR A 16 SERIES AIRFOIL WITH A GIVEN CAMBER.
C
C THIS SUBROUTINE RELATES CL,CD,CL/CD,MACH,T/C,AND ALPHA.
C IT REPRESENTS THE DATA OF A 16-4XX AIRFOIL.
C
C XM=RELATIVE MACH NO. AT BLADE ELEMENT
C AA=ANGLE OF ATTACK IN DEGREES
C IKEY1: CL=CL(MACH,ALPHA,T/C)
C      : CD=CD(MACH,CL,T/C)
C      :XLD=CL/CD
C IKEY2: ALPHA=ALPHA(MACH,CL,T/C)
C      : CD=CD(MACH,CL,T/C)
C      :XLD=CL/CD
C TR=T/C
C
C
C
C
      DIMENSION IORDER(2),IPT(2),ALP404(26,9),ALP406(26,9),
     & ALP409(26,9),ALP412(26,9),ALP415(26,9),ALP418(26,9),
     & ALP421(26,9),CLI(9),XMI(26),ALPI(7),CL404(7,26),
     & CL406(7,26),CL409(7,26),CL412(7,26),CL415(7,26),
     & CL418(7,26),CL421(7,26),CD404(5,26),CD406(5,26),
     & CD409(5,26),CD412(5,26),CD415(5,26),CD418(5,26),
     & CD421(5,26),CLII(5)
      DATA((CL404(I,J),J=1,26),I=1,4)/
     1 -.107, -.122, -.130, -.132, -.131, -.129, -.126, -.124, -.120,
     1 -.116, -.108, -.095, -.083, -.061, -.058, -.086, -.193, -.245,
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1 -.219, -.194, -.173, -.164, -.182, -.262, -.277, -.258,
2  .123,  .129,  .140,  .150,  .160,  .165,  .171,  .177,  .182,
2  .196,  .211,  .225,  .239,  .234,  .208,  .145,  .035,  .002,
2  .033,  .075,  .108,  .113,  .094, -.035, -.115, -.123,
3  .354,  .373,  .392,  .404,  .416,  .421,  .427,  .434,  .445,
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3  .289,  .320,  .346,  .361,  .335,  .154,  .023, -.015,
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 DATA((CL404(I,J),J=1,26),I=5,7)/
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6 1.092, 1.073, 1.052, 1.027,  .998,  .969,  .928,  .882,  .868,
6  .891,  .937,  .972,  .978,  .938,  .618,  .395,  .314,
7 1.019, 1.074, 1.123, 1.152, 1.193, 1.213, 1.222, 1.215, 1.204,
7 1.183, 1.161, 1.135, 1.108, 1.081, 1.054, 1.030, 1.006,  .995,
7 1.020, 1.059, 1.098, 1.108, 1.075,  .761,  .534,  .425/
 DATA((CL406(I,J),J=1,26),I=1,4)/
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1 -.086, -.081, -.077, -.113, -.207, -.317, -.426, -.484, -.452,
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3  .473,  .477,  .446,  .381,  .317,  .252,  .184,  .157,  .188,
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 DATA((CL406(I,J),J=1,26),I=5,7)/
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5  .896,  .860,  .816,  .772,  .727,  .674,  .621,  .595,  .624,
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7 1.079, 1.047, 1.016,  .984,  .952,  .920,  .882,  .858,  .887,
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 DATA((CL409(I,J),J=1,26),I=1,4)/
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 DATA((CL409(I,J),J=1,26),I=5,7)/
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6  .862,  .796,  .731,  .665,  .600,  .551,  .559,  .611,  .666,
6  .708,  .703,  .681,  .658,  .634,  .499,  .385,  .300,
7  .947, 1.008, 1.062, 1.094, 1.110, 1.099, 1.072, 1.042,  .988,
7  .930,  .871,  .813,  .755,  .696,  .650,  .657,  .712,  .772,
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 DATA((CL412(I,J),J=1,26),I=1,4)/
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3  .088,  .077,  .065,  .054,  .047,  .007, -.027, -.053,
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4  .266,  .253,  .241,  .229,  .217,  .153,  .106,  .063/
 DATA((CL412(I,J),J=1,26),I=5,7)/
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5  .423,  .410,  .397,  .384,  .371,  .296,  .234,  .175,
6  .738,  .802,  .847,  .877,  .909,  .898,  .854,  .792,  .716,
6  .639,  .563,  .487,  .411,  .386,  .424,  .492,  .561,  .595,
6  .589,  .574,  .558,  .542,  .526,  .428,  .356,  .286,
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 DATA((CL415(I,J),J=1,26),I=1,4)/
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4  .267,  .127, -.018, -.063, -.014,  .082,  .150,  .178,  .174,
4  .168,  .163,  .157,  .151,  .145,  .115,  .089,  .069/
 DATA((CL415(I,J),J=1,26),I=5,7)/
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5  .329,  .228,  .141,  .108,  .151,  .240,  .321,  .350,  .341,
5  .332,  .323,  .314,  .305,  .297,  .248,  .210,  .180,
6  .671,  .711,  .746,  .771,  .791,  .778,  .741,  .667,  .575,
6  .466,  .356,  .253,  .194,  .237,  .332,  .424,  .455,  .451,
6  .442,  .433,  .424,  .415,  .405,  .353,  .321,  .294,
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 DATA((CL418(I,J),J=1,26),I=1,4)/
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1 -.591, -.684, -.745, -.727, -.636, -.516, -.405, -.378, -.377,
1 -.378, -.379, -.379, -.380, -.380, -.383, -.373, -.361,
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4  .378,  .387,  .398,  .404,  .397,  .334,  .250,  .146,  .033,
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 DATA((CL418(I,J),J=1,26),I=5,7)/
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6  .624,  .649,  .689,  .721,  .663,  .573,  .480,  .388,  .295,
6  .202,  .123,  .098,  .133,  .261,  .374,  .404,  .401,  .392,
6  .384,  .377,  .369,  .361,  .354,  .311,  .273,  .236,
7  .720,  .761,  .808,  .839,  .795,  .722,  .629,  .519,  .396,
7  .271,  .160,  .127,  .177,  .301,  .413,  .435,  .435,  .426,
7  .417,  .409,  .401,  .394,  .386,  .342,  .300,  .263/
 DATA((CL421(I,J),J=1,26),I=1,4)/
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1 -.611, -.639, -.613, -.547, -.453, -.369, -.363, -.372, -.381,
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3  .117,  .126,  .135,  .137,  .116,  .086,  .028, -.069, -.186,
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 DATA((CL421(I,J),J=1,26),I=5,7)/
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5 -.040, -.107, -.061,  .101,  .197,  .229,  .227,  .226,  .219,
5  .212,  .205,  .198,  .191,  .186,  .154,  .132,  .110,
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6  .064,  .008,  .054,  .178,  .299,  .337,  .331,  .325,  .319,
6  .313,  .307,  .300,  .294,  .288,  .251,  .222,  .186,
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7  .116,  .050,  .087,  .220,  .337,  .380,  .373,  .367,  .360,
7  .354,  .348,  .342,  .336,  .330,  .293,  .258,  .232/
 DATA((ALP404(J,N),N=1,9),J=1,13)/
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& -6.22, -4.62, -3.03, -1.42,   .24,  1.99,  4.49,  6.95,  9.79,
& -6.00, -4.52, -3.04, -1.52,   .07,  1.82,  4.07,  6.28,  9.08,
& -5.90, -4.48, -3.06, -1.61,  -.03,  1.68,  3.77,  5.94,  8.66,
& -5.85, -4.47, -3.10, -1.69,  -.13,  1.54,  3.49,  5.56,  8.09,
& -5.84, -4.48, -3.12, -1.73,  -.16,  1.48,  3.34,  5.38,  7.83,
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& -5.85, -4.50, -3.15, -1.77,  -.21,  1.41,  3.19,  5.19,  7.70,
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& -5.85, -4.53, -3.21, -1.86,  -.34,  1.26,  2.92,  4.86,  7.93,
& -5.82, -4.54, -3.26, -1.97,  -.43,  1.18,  2.82,  4.77,  8.37,
& -5.83, -4.58, -3.32, -2.07,  -.53,  1.09,  2.78,  4.90,  8.89,
& -5.91, -4.66, -3.41, -2.16,  -.62,   .99,  2.77,  5.19,  9.57,
& -5.97, -4.73, -3.48, -2.24,  -.71,   .97,  2.90,  5.57, 10.27/
 DATA((ALP404(J,N),N=1,9),J=14,26)/
& -6.30, -4.94, -3.59, -2.23,  -.59,  1.30,  3.31,  6.05, 10.87,
& -6.57, -5.07, -3.56, -2.06,  -.10,  1.81,  3.76,  6.73, 11.44,
& -6.72, -4.99, -3.26, -1.43,   .53,  2.29,  4.33,  7.41, 11.33,
& -5.82, -4.06, -2.31,  -.69,   .97,  2.76,  4.92,  7.90, 11.13,
& -5.26, -3.64, -2.02,  -.48,  1.20,  2.96,  5.10,  8.08, 11.23,
& -5.44, -3.85, -2.26,  -.70,   .97,  2.71,  4.74,  7.69, 10.79,
& -5.53, -4.04, -2.56,  -.98,   .67,  2.36,  4.14,  7.03, 10.31,
& -5.62, -4.19, -2.77, -1.23,   .43,  2.03,  3.81,  6.44,  9.62,
& -5.70, -4.26, -2.82, -1.30,   .30,  1.85,  3.73,  6.34,  9.42,
& -5.58, -4.13, -2.68, -1.12,   .50,  2.05,  4.18,  6.91,  9.82,
& -5.22, -3.45, -1.63,   .61,  3.10,  5.74,  8.55, 11.34, 14.14,
& -5.52, -3.05,  -.33,  3.00,  6.07,  8.95, 11.83, 14.71, 17.58,
& -6.10, -3.14,   .28,  3.84,  7.55, 11.15, 14.76, 18.36, 21.96/
 DATA((ALP406(J,N),N=1,9),J=1,13)/
& -5.99, -4.45, -2.90, -1.28,   .51,  2.71,  5.31,  7.87, 10.47,
& -6.16, -4.58, -3.01, -1.40,   .28,  2.06,  4.73,  7.19,  9.71,
& -6.22, -4.65, -3.08, -1.50,   .10,  1.77,  4.19,  6.64,  8.93,
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& -6.29, -4.74, -3.19, -1.66,  -.17,  1.48,  3.54,  5.98,  8.05,
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& -6.31, -4.79, -3.26, -1.75,  -.30,  1.29,  3.18,  5.73,  8.32,
& -6.31, -4.80, -3.29, -1.79,  -.35,  1.21,  3.00,  5.90,  8.83,
& -6.33, -4.83, -3.32, -1.83,  -.43,  1.12,  2.89,  6.21,  9.44,
& -6.34, -4.85, -3.36, -1.88,  -.50,  1.08,  2.98,  6.65, 10.07,
& -6.46, -4.92, -3.37, -1.85,  -.52,  1.18,  3.31,  7.16, 10.73,
& -6.86, -5.09, -3.32, -1.66,  -.31,  1.63,  3.82,  7.70, 11.41,
& -6.88, -4.87, -2.86, -1.23,   .19,  2.20,  4.57,  8.28, 11.79/
 DATA((ALP406(J,N),N=1,9),J=14,26)/
& -5.72, -3.94, -2.15,  -.78,   .79,  2.73,  5.42,  8.79, 12.07,
& -4.63, -3.12, -1.66,  -.34,  1.34,  3.26,  6.15,  9.23, 12.31,
& -3.83, -2.52, -1.21,   .13,  1.79,  3.79,  6.79,  9.74, 12.68,
& -3.52, -2.36, -1.07,   .36,  2.02,  4.07,  7.06, 10.31, 13.56,
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& -4.37, -3.08, -1.79,  -.47,  1.12,  2.93,  5.34,  8.49, 11.64,
& -4.58, -3.25, -1.92,  -.55,  1.02,  2.81,  5.09,  8.21, 11.41,
& -4.53, -3.16, -1.79,  -.40,  1.29,  3.20,  5.60,  8.66, 11.78,
& -4.45, -3.02, -1.60,  -.19,  1.67,  3.74,  6.41,  9.23, 12.04,
& -4.02, -2.40,  -.65,  1.74,  4.55,  7.25,  9.80, 12.34, 14.89,
& -3.84, -2.30,   .22,  3.42,  6.38,  9.38, 12.39, 15.40, 18.41,
& -3.76, -2.29,   .42,  4.02,  7.61, 11.00, 14.39, 17.78, 21.17/
 DATA((ALP409(J,N),N=1,9),J=1,13)/
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& -7.25, -5.30, -3.35, -1.37,   .62,  2.68,  5.15,  7.89, 10.72,
& -7.61, -5.58, -3.55, -1.53,   .44,  2.35,  4.60,  7.14,  9.90,
& -7.83, -5.75, -3.67, -1.61,   .32,  2.16,  4.29,  6.75,  9.40,
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```
& -8.09, -5.99, -3.88, -1.80,   .10,  1.83,  3.85,  6.22,  9.82,
& -8.19, -6.07, -3.96, -1.86,   .03,  1.71,  3.71,  6.20, 11.20,
& -8.32, -6.18, -4.04, -1.92,  -.06,  1.62,  3.62,  6.76, 12.65,
& -8.40, -6.26, -4.12, -1.98,  -.14,  1.56,  3.78,  8.39, 14.95,
& -8.31, -6.24, -4.17, -2.09,  -.15,  1.71,  4.69, 10.06, 15.94,
& -9.22, -6.70, -4.19, -1.77,  0.00,  2.33,  6.11, 11.44, 16.77,
&-10.46, -7.07, -3.68, -1.10,   .90,  3.89,  7.68, 12.56, 17.44,
&-10.76, -6.31, -1.94,  -.09,  2.11,  5.06,  9.00, 13.44, 17.89/
 DATA((ALP409(J,N),N=1,9),J=14,26)/
& -7.72, -3.76,  -.86,  1.11,  3.41,  6.00, 10.17, 14.33, 18.50,
& -3.80, -1.94,  -.10,  1.77,  4.16,  6.99, 11.03, 15.07, 19.11,
& -3.53, -1.85,  -.09,  1.82,  4.15,  6.84, 10.92, 15.00, 19.08,
& -3.80, -2.24,  -.54,  1.33,  3.54,  5.87,  9.74, 13.70, 17.66,
& -4.46, -2.78, -1.05,   .77,  2.85,  5.22,  8.53, 12.30, 16.08,
& -5.15, -3.30, -1.45,   .39,  2.38,  4.70,  7.75, 11.56, 15.37,
& -5.20, -3.34, -1.48,   .37,  2.35,  4.76,  8.00, 12.12, 16.25,
& -5.20, -3.26, -1.36,   .50,  2.58,  5.02,  8.43, 12.51, 16.59,
& -5.20, -3.18, -1.24,   .66,  2.86,  5.31,  8.84, 12.84, 16.84,
& -5.20, -3.11, -1.13,   .84,  3.15,  5.59,  9.22, 13.11, 16.99,
& -5.07, -2.80,  -.50,  2.07,  4.77,  7.77, 11.28, 14.79, 18.30,
& -5.13, -2.65,   .22,  3.31,  6.26,  9.71, 13.16, 16.60, 20.05,
& -5.40, -2.52,   .51,  4.08,  7.75, 11.26, 14.77, 18.28, 21.79/
 DATA((ALP412(J,N),N=1,9),J=1,13)/
& -8.13, -5.75, -3.37, -1.00,  1.25,  3.90,  7.00, 10.23, 13.45,
& -7.81, -5.66, -3.51, -1.28,   .99,  3.36,  5.97,  9.41, 12.86,
& -7.35, -5.42, -3.49, -1.44,   .84,  3.03,  5.43,  8.49, 11.74,
& -7.10, -5.29, -3.48, -1.55,   .74,  2.81,  5.10,  7.88, 10.93,
& -6.84, -5.16, -3.49, -1.72,   .64,  2.61,  4.79,  7.50, 10.81,
& -6.68, -5.08, -3.48, -1.81,   .56,  2.53,  4.80,  7.96, 11.81,
& -6.45, -4.94, -3.43, -1.87,   .50,  2.56,  5.22,  8.81, 12.65,
& -6.32, -4.85, -3.37, -1.83,   .51,  3.22,  6.17, 10.33, 14.50,
& -6.59, -4.89, -3.18, -1.38,   .83,  4.50,  7.77, 11.98, 16.19,
& -5.78, -4.17, -2.56,  -.77,  1.84,  5.50,  9.35, 13.52, 17.69,
& -5.00, -3.41, -1.76,   .43,  3.88,  6.77, 10.94, 15.10, 19.27,
& -4.27, -2.49,  -.46,  2.02,  4.90,  8.38, 12.59, 16.80, 21.01,
& -3.22, -1.11,   .88,  3.25,  5.85,  9.98, 14.19, 18.40, 22.61/
 DATA((ALP412(J,N),N=1,9),J=14,26)/
& -2.36,  -.61,  1.34,  3.71,  6.34, 11.16, 15.98, 20.80, 25.61,
& -2.75,  -.87,   .96,  3.24,  5.70, 10.24, 15.06, 19.88, 24.70,
& -3.78, -1.62,   .10,  2.34,  4.80,  8.54, 13.25, 17.95, 22.66,
& -5.03, -2.58,  -.58,  1.50,  3.90,  6.89, 11.43, 15.98, 20.52,
& -5.84, -3.01,  -.83,  1.18,  3.55,  6.12, 10.94, 15.76, 20.58,
& -5.74, -3.04,  -.83,  1.26,  3.71,  6.28, 11.28, 16.28, 21.28,
& -5.68, -3.01,  -.77,  1.40,  3.87,  6.66, 11.72, 16.78, 21.85,
& -5.65, -2.97,  -.67,  1.53,  4.04,  7.05, 12.05, 17.05, 22.05,
& -5.65, -2.93,  -.58,  1.67,  4.20,  7.45, 12.45, 17.45, 22.45,
& -5.62, -2.88,  -.51,  1.80,  4.37,  7.83, 12.77, 17.70, 22.64,
& -5.49, -2.59,  -.08,  2.66,  5.58,  9.55, 13.67, 17.79, 21.92,
& -5.38, -2.21,   .41,  3.47,  6.88, 10.88, 14.88, 18.88, 22.88,
& -5.10, -2.05,   .91,  4.45,  8.11, 11.81, 15.52, 19.22, 22.93/
 DATA((ALP415(J,N),N=1,9),J=1,13)/
& -8.62, -5.82, -3.02,  -.48,  1.76,  4.75,  8.63, 12.71, 16.80,
& -8.19, -5.63, -3.06,  -.56,  1.60,  4.24,  7.82, 11.90, 15.98,
& -7.55, -5.32, -3.08,  -.69,  1.47,  3.91,  7.07, 11.03, 14.99,
& -7.25, -5.17, -3.08,  -.76,  1.40,  3.74,  6.52, 10.13, 13.73,
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& -7.00, -5.04, -3.08,  -.82,  1.34,  3.58,  6.15,  9.51, 12.87,
& -6.90, -4.98, -3.06,  -.84,  1.30,  3.62,  6.37,  9.70, 13.03,
& -6.68, -4.82, -2.97,  -.82,  1.44,  4.00,  7.02, 10.47, 13.91,
& -5.99, -4.35, -2.71,  -.54,  1.86,  5.01,  8.58, 12.47, 16.35,
& -5.34, -3.80, -2.26,   .20,  3.29,  6.63, 11.63, 16.63, 21.63,
& -4.60, -3.06, -1.19,  1.23,  5.04,  9.67, 15.15, 20.63, 26.11,
& -3.78, -2.05,   .48,  3.45,  7.31, 13.28, 19.25, 25.22, 31.19,
& -2.52,  -.05,  2.23,  5.05, 10.74, 17.19, 23.65, 30.10, 36.55,
& -1.96,   .63,  2.74,  6.16, 11.49, 16.83, 22.16, 27.49, 32.83/
 DATA((ALP415(J,N),N=1,9),J=14,26)/
& -2.15,   .26,  2.17,  5.14, 10.47, 15.95, 21.42, 26.90, 32.38,
& -3.27,  -.83,  1.20,  3.49,  7.97, 13.77, 19.57, 25.36, 31.16,
& -4.53, -1.72,   .36,  2.58,  5.53, 11.87, 18.53, 25.20, 31.87,
& -5.79, -2.02,   .13,  2.26,  4.95, 10.92, 17.69, 24.47, 31.25,
& -5.92, -2.11,   .15,  2.31,  5.07, 11.32, 18.46, 25.61, 32.75,
& -5.92, -2.11,   .17,  2.39,  5.24, 11.45, 18.34, 25.24, 32.14,
& -5.92, -2.11,   .19,  2.46,  5.40, 11.76, 18.66, 25.55, 32.45,
& -5.91, -2.13,   .22,  2.55,  5.56, 12.18, 19.19, 26.21, 33.23,
& -5.91, -2.13,   .24,  2.64,  5.73, 12.61, 19.75, 26.89, 34.04,
& -5.91, -2.13,   .27,  2.72,  5.91, 12.72, 19.62, 26.52, 33.41,
& -5.89, -2.11,   .45,  3.28,  7.34, 13.06, 18.77, 24.49, 30.20,
& -6.00, -1.93,   .62,  3.83,  8.36, 14.33, 20.30, 26.27, 32.24,
& -6.18, -1.80,   .75,  4.35,  9.07, 14.87, 20.67, 26.46, 32.26/
 DATA((ALP418(J,N),N=1,9),J=1,13)/
& -7.92, -5.32, -2.73,  -.05,  2.30,  5.51,  9.67, 13.83, 18.00,
& -7.86, -5.28, -2.70,  -.16,  2.18,  5.15,  8.70, 12.27, 15.84,
& -7.22, -4.92, -2.62,  -.25,  2.03,  4.74,  7.87, 11.23, 14.59,
& -6.88, -4.76, -2.63,  -.31,  1.96,  4.53,  7.34, 10.73, 14.12,
& -6.40, -4.49, -2.57,  -.30,  2.04,  4.98,  8.08, 11.11, 14.14,
& -5.86, -3.95, -2.05,   .20,  3.07,  6.36,  9.05, 11.73, 14.42,
& -4.91, -3.05, -1.02,  1.37,  4.62,  7.61, 10.30, 12.98, 15.66,
& -4.02, -2.01,   .22,  2.86,  6.18,  9.24, 12.29, 15.34, 18.40,
& -2.97,  -.80,  1.58,  4.36,  8.08, 12.04, 16.00, 19.96, 23.92,
& -1.77,   .45,  2.96,  5.97, 11.74, 17.54, 23.33, 29.13, 34.93,
&  -.63,  1.66,  3.95, 10.16, 20.97, 31.78, 42.59, 53.41, 64.22,
&  -.11,  2.13,  4.55, 13.03, 26.83, 40.62, 54.41, 68.21, 82.00,
&  -.49,  1.72,  3.91,  9.05, 18.14, 27.23, 36.32, 45.41, 54.50/
 DATA((ALP418(J,N),N=1,9),J=14,26)/
& -1.66,   .37,  2.46,  5.05, 12.95, 22.95, 32.95, 42.95, 52.95,
& -2.88,  -.87,  1.21,  3.36,  7.33, 17.59, 27.85, 38.10, 48.36,
& -3.94, -1.43,   .92,  3.14,  5.94, 18.65, 31.55, 44.45, 57.35,
& -4.33, -1.44,   .91,  3.14,  5.98, 17.71, 29.47, 41.24, 53.00,
& -4.35, -1.43,   .94,  3.21,  6.47, 18.24, 30.00, 41.76, 53.53,
& -4.33, -1.43,   .97,  3.29,  6.97, 19.09, 31.21, 43.33, 55.45,
& -4.32, -1.43,  1.01,  3.37,  7.44, 19.94, 32.44, 44.94, 57.44,
& -4.32, -1.42,  1.05,  3.45,  7.94, 20.44, 32.94, 45.44, 57.94,
& -4.30, -1.41,  1.08,  3.54,  8.36, 20.48, 32.61, 44.73, 56.85,
& -4.30, -1.41,  1.11,  3.62,  8.88, 21.38, 33.88, 46.38, 58.88,
& -4.25, -1.37,  1.30,  4.20, 11.74, 24.65, 37.55, 50.45, 63.35,
& -4.43, -1.37,  1.45,  4.72, 15.41, 30.22, 45.04, 59.85, 74.67,
& -4.70, -1.36,  1.61,  5.31, 18.15, 32.96, 47.78, 62.59, 77.41/
 DATA((ALP421(J,N),N=1,9),J=1,13)/
& -4.73, -2.95, -1.11,   .88,  3.28,  7.70, 15.25, 22.79, 30.34,
& -4.78, -3.05, -1.24,   .80,  3.14,  6.57, 11.77, 16.96, 22.16,
& -4.89, -3.16, -1.35,   .69,  2.92,  5.91,  9.15, 12.37, 15.60,
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& -5.00, -3.23, -1.38,   .66,  2.85,  5.67,  8.77, 11.85, 14.92,
& -5.00, -3.13, -1.18,   .87,  3.08,  6.20, 10.16, 14.12, 18.08,
& -4.74, -2.77,  -.83,  1.23,  3.62,  7.56, 11.73, 15.90, 20.06,
& -4.17, -2.27,  -.28,  2.14,  5.06, 10.53, 16.41, 22.29, 28.18,
& -3.47, -1.36,  1.12,  3.64,  8.16, 13.49, 18.83, 24.16, 29.49,
& -2.57,  -.17,  2.96,  6.25, 12.60, 18.95, 25.30, 31.65, 38.00,
& -1.27,  2.26,  4.77, 11.23, 18.92, 26.62, 34.31, 42.00, 49.69,
&  -.54,  2.82,  5.86, 15.14, 24.67, 34.19, 43.71, 53.24, 62.76,
& -1.19,  2.29,  5.06, 14.85, 26.97, 39.09, 51.21, 63.33, 75.45,
& -2.36,  -.13,  2.85,  7.05, 16.57, 26.10, 35.62, 45.14, 54.67/
 DATA((ALP421(J,N),N=1,9),J=14,26)/
& -3.44, -1.37,  1.16,  4.06, 11.32, 21.84, 32.37, 42.89, 53.42,
& -4.32, -2.28,   .54,  3.64,  8.93, 18.23, 27.53, 36.84, 46.14,
& -4.34, -2.49,   .58,  3.66,  9.29, 18.81, 28.33, 37.86, 47.38,
& -4.26, -2.39,   .65,  3.68,  9.57, 19.10, 28.62, 38.14, 47.67,
& -4.18, -2.29,   .73,  3.76,  9.95, 19.71, 29.46, 39.22, 48.98,
& -4.08, -2.21,   .81,  3.85, 10.24, 20.00, 29.76, 39.51, 49.27,
& -4.00, -2.17,   .92,  3.93, 10.54, 20.29, 30.05, 39.80, 49.56,
& -3.90, -2.11,  1.00,  4.04, 10.76, 20.29, 29.81, 39.33, 48.86,
& -3.80, -2.05,  1.08,  4.17, 11.05, 20.57, 30.10, 39.62, 49.14,
& -3.72, -2.00,  1.18,  4.27, 11.33, 20.86, 30.38, 39.90, 49.43,
& -3.62, -1.79,  1.58,  4.95, 13.10, 22.62, 32.14, 41.67, 51.19,
& -3.64, -1.69,  1.95,  5.51, 15.89, 27.00, 38.11, 49.22, 60.33,
& -3.68, -1.60,  2.20,  6.61, 15.30, 24.00, 32.70, 41.39, 50.09/
 DATA((CD404(I,J),J=1,26),I=1,5)/
1 .0134, .0132, .0131, .0131, .0130, .0130, .0130, .0130, .0129,
1 .0129, .0129, .0136, .0158, .0204, .0261, .0329, .0401, .0434,
1 .0465, .0489, .0501, .0505, .0501, .0409, .0299, .0241,
2 .0063, .0061, .0053, .0053, .0053, .0053, .0053, .0053, .0053,
2 .0056, .0059, .0083, .0116, .0154, .0212, .0268, .0315, .0340,
2 .0365, .0384, .0397, .0410, .0423, .0403, .0360, .0339,
3 .0049, .0049, .0048, .0048, .0048, .0048, .0048, .0049, .0050,
3 .0053, .0061, .0077, .0112, .0175, .0254, .0306, .0348, .0387,
3 .0406, .0424, .0442, .0459, .0470, .0531, .0596, .0692,
4 .0068, .0066, .0058, .0057, .0056, .0056, .0056, .0057, .0058,
4 .0061, .0069, .0093, .0154, .0230, .0325, .0408, .0482, .0539,
4 .0591, .0644, .0698, .0752, .0803, .0963, .1089, .1298,
5 .0231, .0143, .0105, .0096, .0091, .0091, .0091, .0093, .0096,
5 .0108, .0153, .0237, .0337, .0460, .0568, .0686, .0817, .0927,
5 .1019, .1112, .1205, .1298, .1379, .1722, .1959, .2106/
 DATA((CD406(I,J),J=1,26),I=1,5)/
1 .0126, .0124, .0124, .0123, .0123, .0123, .0122, .0122, .0122,
1 .0122, .0125, .0139, .0183, .0235, .0299, .0365, .0432, .0478,
1 .0516, .0543, .0570, .0583, .0589, .0523, .0393, .0291,
2 .0057, .0056, .0056, .0056, .0057, .0057, .0057, .0059, .0062,
2 .0072, .0093, .0124, .0158, .0203, .0251, .0299, .0350, .0400,
2 .0434, .0467, .0483, .0499, .0506, .0493, .0439, .0403,
3 .0049, .0049, .0047, .0046, .0046, .0046, .0046, .0047, .0050,
3 .0059, .0074, .0110, .0151, .0192, .0253, .0318, .0379, .0429,
3 .0460, .0489, .0512, .0532, .0551, .0635, .0697, .0759,
4 .0059, .0056, .0055, .0055, .0054, .0053, .0052, .0052, .0056,
4 .0067, .0097, .0130, .0177, .0257, .0358, .0455, .0543, .0624,
4 .0695, .0757, .0820, .0867, .0903, .1088, .1225, .1313,
5 .0205, .0133, .0113, .0107, .0104, .0106, .0108, .0111, .0123,
5 .0147, .0181, .0268, .0422, .0610, .0798, .0979, .1106, .1233,
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5 .1348, .1458, .1568, .1663, .1744, .2053, .2201, .2248/
 DATA((CD409(I,J),J=1,26),I=1,5)/
1 .0106, .0106, .0106, .0106, .0106, .0107, .0107, .0107, .0110,
1 .0122, .0147, .0192, .0245, .0305, .0379, .0459, .0537, .0614,
1 .0693, .0772, .0832, .0869, .0891, .0829, .0635, .0493,
2 .0062, .0062, .0062, .0062, .0062, .0062, .0062, .0063, .0066,
2 .0085, .0121, .0165, .0220, .0283, .0349, .0416, .0483, .0546,
2 .0607, .0664, .0717, .0746, .0768, .0741, .0681, .0579,
3 .0062, .0062, .0062, .0062, .0062, .0062, .0062, .0062, .0062,
3 .0062, .0062, .0062, .0062, .0062, .0062, .0062, .0062, .0062,
3 .0062, .0062, .0062, .0062, .0062, .0062, .0062, .0062,
4 .0054, .0055, .0055, .0056, .0056, .0056, .0058, .0059, .0069,
4 .0093, .0131, .0177, .0240, .0306, .0403, .0499, .0588, .0661,
4 .0710, .0754, .0792, .0830, .0846, .0890, .0907, .0924,
5 .0084, .0071, .0064, .0063, .0063, .0065, .0068, .0072, .0087,
5 .0127, .0189, .0251, .0314, .0405, .0541, .0690, .0814, .0891,
5 .0966, .1038, .1092, .1135, .1177, .1336, .1443, .1516/
 DATA((CD412(I,J),J=1,26),I=1,5)/
1 .0058, .0058, .0058, .0058, .0058, .0058, .0058, .0058, .0058,
1 .0061, .0068, .0129, .0235, .0348, .0456, .0547, .0607, .0649,
1 .0684, .0706, .0723, .0741, .0751, .0754, .0752, .0700,
2 .0083, .0083, .0083, .0083, .0083, .0083, .0084, .0084, .0084,
2 .0091, .0146, .0241, .0340, .0444, .0539, .0614, .0670, .0708,
2 .0738, .0759, .0775, .0787, .0794, .0820, .0826, .0812,
3 .0150, .0150, .0150, .0150, .0150, .0151, .0152, .0153, .0158,
3 .0187, .0262, .0354, .0454, .0556, .0650, .0721, .0784, .0839,
3 .0882, .0912, .0942, .0965, .0986, .1058, .1100, .1142,
4 .0233, .0251, .0259, .0264, .0268, .0270, .0272, .0283, .0312,
4 .0428, .0598, .0776, .0917, .1023, .1106, .1188, .1251, .1309,
4 .1356, .1381, .1406, .1431, .1459, .1583, .1664, .1710,
5 .0338, .0390, .0416, .0427, .0447, .0462, .0509, .0592, .0715,
5 .0894, .1082, .1263, .1432, .1581, .1707, .1799, .1864, .1900,
5 .1934, .1935, .1936, .1937, .1938, .1944, .1950, .1956/
 DATA((CD415(I,J),J=1,26),I=1,5)/
1 .0107, .0138, .0153, .0161, .0169, .0173, .0176, .0190, .0219,
1 .0266, .0376, .0501, .0642, .0750, .0858, .0967, .1062, .1152,
1 .1242, .1306, .1368, .1430, .1445, .1400, .1245, .1071,
2 .0093, .0093, .0094, .0094, .0096, .0100, .0107, .0120, .0169,
2 .0271, .0388, .0515, .0655, .0784, .0906, .1009, .1107, .1193,
2 .1267, .1328, .1382, .1436, .1464, .1380, .1291, .1177,
3 .0084, .0083, .0083, .0083, .0085, .0091, .0104, .0130, .0198,
3 .0310, .0432, .0550, .0689, .0820, .0948, .1048, .1147, .1244,
3 .1330, .1416, .1500, .1532, .1563, .1623, .1560, .1497,
4 .0096, .0096, .0096, .0096, .0102, .0108, .0124, .0158, .0224,
4 .0351, .0497, .0657, .0797, .0926, .1056, .1183, .1308, .1433,
4 .1557, .1634, .1706, .1777, .1849, .2016, .2093, .2158,
5 .0192, .0163, .0158, .0162, .0178, .0193, .0215, .0350, .0543,
5 .0771, .0977, .1154, .1352, .1561, .1724, .1858, .1993, .2114,
5 .2205, .2297, .2388, .2455, .2510, .2702, .2753, .2803/
 DATA((CD418(I,J),J=1,26),I=1,5)/
1 .0122, .0154, .0170, .0180, .0190, .0200, .0219, .0253, .0369,
1 .0555, .0737, .0897, .1011, .1118, .1199, .1279, .1360, .1419,
1 .1469, .1518, .1557, .1574, .1590, .1624, .1569, .1480,
2 .0100, .0099, .0098, .0097, .0101, .0107, .0131, .0210, .0420,
2 .0601, .0772, .0939, .1071, .1176, .1282, .1386, .1420, .1453,
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2 .1487, .1520, .1554, .1587, .1621, .1720, .1660, .1530,
3 .0102, .0104, .0105, .0106, .0113, .0124, .0150, .0217, .0419,
3 .0624, .0822, .1017, .1148, .1275, .1387, .1475, .1563, .1652,
3 .1710, .1755, .1799, .1843, .1888, .1904, .1887, .1772,
4 .0162, .0137, .0131, .0135, .0147, .0159, .0194, .0278, .0459,
4 .0681, .0902, .1111, .1276, .1420, .1564, .1669, .1766, .1864,
4 .1936, .2002, .2068, .2122, .2154, .2299, .2336, .2336,
5 .0231, .0287, .0315, .0329, .0352, .0378, .0444, .0588, .0839,
5 .1165, .1453, .1712, .1945, .2177, .2329, .2480, .2630, .2723,
5 .2809, .2895, .2981, .3024, .3055, .3204, .3284, .3364/
 DATA((CD421(I,J),J=1,26),I=1,5)/
1 .0141, .0150, .0154, .0156, .0159, .0166, .0204, .0316, .0471,
1 .0636, .0797, .0950, .1109, .1273, .1437, .1563, .1687, .1781,
1 .1842, .1903, .1935, .1956, .1977, .1994, .2002, .2010,
2 .0123, .0127, .0129, .0130, .0134, .0146, .0216, .0350, .0507,
2 .0694, .0857, .1019, .1178, .1337, .1501, .1667, .1798, .1891,
2 .1985, .2047, .2098, .2149, .2178, .2178, .2178, .2178,
3 .0138, .0143, .0146, .0147, .0151, .0167, .0243, .0400, .0584,
3 .0766, .0945, .1141, .1331, .1503, .1676, .1801, .1921, .2041,
3 .2122, .2185, .2247, .2310, .2352, .2428, .2449, .2470,
4 .0152, .0159, .0163, .0165, .0171, .0187, .0244, .0356, .0550,
4 .0788, .1033, .1260, .1472, .1670, .1836, .2003, .2169, .2279,
4 .2386, .2492, .2599, .2657, .2706, .2809, .2821, .2833,
5 .0329, .0321, .0337, .0355, .0382, .0417, .0606, .0877, .1144,
5 .1406, .1662, .1919, .2139, .2359, .2578, .2743, .2896, .3049,
5 .3203, .3260, .3310, .3360, .3402, .3389, .3376, .3363/
 DATA(XMI(J),J=1,26)/.3,.5,.6,.65,.7,.725,.75,.775,
& .8,.825,.85,.875,.9,.925,.95,.975,1.0,1.025,1.05,1.075,
&1.1,1.125,1.15,1.3,1.45,1.6/
 DATA(CLI(J),J=1,9)/-.4,-.2,0.0,.2,.4,.6,.8,1.0,1.2/
 DATA(ALPI(J),J=1,7)/-4.0,-2.0,0.0,2.0,4.0,6.0,8.0/
 DATA(CLII(J),J=1,5)/0.0,.2,.4,.6,.8/
 IORDER(1)=IORDER(2)=1
 IPT (1) = -1
 IF (IKEY .EQ. 2) GO TO 1000
 IF (TR .LT. .04) GO TO 9
 IF (TR .GE. .04 .AND. TR .LT. .06) GO TO 1
 IF (TR .GE. .06 .AND. TR .LT. .09) GO TO 2
 IF (TR .GE. .09 .AND. TR .LT. .12) GO TO 3
 IF (TR .GE. .12 .AND. TR .LT. .15) GO TO 4
 IF (TR .GE. .15 .AND. TR .LT. .18) GO TO 5
 IF (TR .GE. .18 .AND. TR .LT. .21) GO TO 6
 IF (TR .GE. .21) GO TO 7
9 CALL IBI (7,ALPI,26,XMI,7,CL404,IORDER,IPT,AA,XM,CLFT04,IERR)
 CL=CLFT04
 GO TO 400
1 CALL IBI (7,ALPI,26,XMI,7,CL404,IORDER,IPT,AA,XM,CLFT04,IERR)
 IPT (1)=-1
 CALL IBI (7,ALPI,26,XMI,7,CL406,IORDER,IPT,AA,XM,CLFT06,IERR)
 CL=CLFT04 + (CLFT06-CLFT04)*((TR-.04)/(.06-.04))
 GO TO 400
2 CALL IBI (7,ALPI,26,XMI,7,CL406,IORDER,IPT,AA,XM,CLFT06,IERR)
 IPT (1)=-1
 CALL IBI (7,ALPI,26,XMI,7,CL409,IORDER,IPT,AA,XM,CLFT09,IERR)
 CL=CLFT06 + (CLFT09 - CLFT06)*((TR-.06)/(.09-.06))
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      GO TO 400
    3 CALL IBI (7,ALPI,26,XMI,7,CL409,IORDER,IPT,AA,XM,CLFT09,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL412,IORDER,IPT,AA,XM,CLFT12,IERR)
      CL=CLFT09+(CLFT12-CLFT09)*((TR-.09)/(.12-.09))
      GO TO 400
    4 CALL IBI (7,ALPI,26,XMI,7,CL412,IORDER,IPT,AA,XM,CLFT12,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL415,IORDER,IPT,AA,XM,CLFT15,IERR)
      CL=CLFT12 + (CLFT15-CLFT12)*((TR-.12)/(.15-.12))
      GO TO 400
    5 CALL IBI (7,ALPI,26,XMI,7,CL415,IORDER,IPT,AA,XM,CLFT15,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL418,IORDER,IPT,AA,XM,CLFT18,IERR)
      CL=CLFT15+(CLFT18-CLFT15)*((TR-.15)/(.18-.15))
      GO TO 400
    6 CALL IBI (7,ALPI,26,XMI,7,CL418,IORDER,IPT,AA,XM,CLFT18,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL421,IORDER,IPT,AA,XM,CLFT21,IERR)
      CL=CLFT18+(CLFT21-CLFT18)*((TR-.18)/(.21-.18))
      GO TO 400
    7 CALL IBI (7,ALPI,26,XMI,7,CL421,IORDER,IPT,AA,XM,CLFT21,IERR)
      CL=CLFT21
      GO TO 400
 1000 CONTINUE
      IPT (1)=-1
      IF (TR .LT. .04) GO TO 90
      IF (TR .GE. .04 .AND. TR .LT. .06) GO TO 10
      IF (TR .GE. .06 .AND. TR .LT. .09) GO TO 20
      IF (TR .GE. .09 .AND. TR .LT. .12) GO TO 30
      IF (TR .GE. .12 .AND. TR .LT. .15) GO TO 40
      IF (TR .GE. .15 .AND. TR .LT. .18) GO TO 50
      IF (TR .GE. .18 .AND. TR .LT. .21) GO TO 60
      IF (TR .GE. .21) GO TO 70
   90 CALL IBI (26,XMI,9,CLI,26,ALP404,IORDER,IPT,XM,CL,AA04,IERR)
      AA=AA04
      GO TO 400
   10 CALL IBI (26,XMI,9,CLI,26,ALP404,IORDER,IPT,XM,CL,AA04,IERR)
      IPT (1) = -1
      CALL IBI (26,XMI,9,CLI,26,ALP406,IORDER,IPT,XM,CL,AA06,IERR)
      AA=AA04 + (AA06-AA04)*((TR-.04)/(.06-.04))
      GO TO 400
   20 CALL IBI (26,XMI,9,CLI,26,ALP406,IORDER,IPT,XM,CL,AA06,IERR)
      IPT (1) = -1
      CALL IBI (26,XMI,9,CLI,26,ALP409,IORDER,IPT,XM,CL,AA09,IERR)
      AA=AA06 + (AA09 - AA06)*((TR -.06)/(.09-.06))
      GO TO 400
   30 CALL IBI (26,XMI,9,CLI,26,ALP409,IORDER,IPT,XM,CL,AA09,IERR)
      IPT (1) = -1
      CALL IBI (26,XMI,9,CLI,26,ALP412,IORDER,IPT,XM,CL,AA12,IERR)
      AA=AA09+(AA12-AA09)*((TR-.09)/(.12-.09))
      GO TO 400
   40 CALL IBI (26,XMI,9,CLI,26,ALP412,IORDER,IPT,XM,CL,AA12,IERR)
      IPT (1) = -1
      CALL IBI (26,XMI,9,CLI,26,ALP415,IORDER,IPT,XM,CL,AA15,IERR)
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      AA=AA12+(AA15-AA12)*((TR-.12)/(.15-.12))
      GO TO 400
   50 CALL IBI (26,XMI,9,CLI,26,ALP415,IORDER,IPT,XM,CL,AA15,IERR)
      IPT (1) = -1
      CALL IBI (26,XMI,9,CLI,26,ALP418,IORDER,IPT,XM,CL,AA18,IERR)
      AA=AA15+(AA18-AA15)*((TR-.15)/(.18-.15))
      GO TO 400
   60 CALL IBI (26,XMI,9,CLI,26,ALP418,IORDER,IPT,XM,CL,AA18,IERR)
      IPT (1) = -1
      CALL IBI (26,XMI,9,CLI,26,ALP421,IORDER,IPT,XM,CL,AA21,IERR)
      AA=AA18+(AA21-AA18)*((TR-.18)/(.21-.18))
      GO TO 400
   70 CALL IBI (26,XMI,9,CLI,26,ALP421,IORDER,IPT,XM,CL,AA21,IERR)
      AA=AA21
  400 CONTINUE
      IPT (1)=-1
      IF (TR .LT. .04) GO TO 91
      IF (TR .GE. .04 .AND. TR .LT. .06) GO TO 11
      IF (TR .GE. .06 .AND. TR .LT. .09) GO TO 21
      IF (TR .GE. .09 .AND. TR .LT. .12) GO TO 31
      IF (TR .GE. .12 .AND. TR .LT. .15) GO TO 41
      IF (TR .GE. .15 .AND. TR .LT. .18) GO TO 51
      IF (TR .GE. .18 .AND. TR .LT. .21) GO TO 61
      IF (TR .GE. .21) GO TO 71
   91 CALL IBI (5,CLII,26,XMI,5,CD404,IORDER,IPT,CL,XM,CDRG04,IERR)
      CD=CDRG04
      WRITE (6,201) TR
  201 FORMAT(*0THICKNESS RATIO=*,F5.3,* IS OUT OF RANGE.
     &*/* THE VALUES FOR T/C=.04 HAVE BEEN RETURNED*)
      GO TO 250
   11 CALL IBI (5,CLII,26,XMI,5,CD404,IORDER,IPT,CL,XM,CDRG04,IERR)
      IPT (1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD406,IORDER,IPT,CL,XM,CDRG06,IERR)
      CD=CDRG04 + (CDRG06-CDRG04)*((TR-.04)/(.06-.04))
      GO TO 250
   21 CALL IBI (5,CLII,26,XMI,5,CD406,IORDER,IPT,CL,XM,CDRG06,IERR)
      IPT (1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD409,IORDER,IPT,CL,XM,CDRG09,IERR)
      CD=CDRG06 + (CDRG09 - CDRG06)*((TR-.06)/(.09-.06))
      GO TO 250
   31 CALL IBI (5,CLII,26,XMI,5,CD409,IORDER,IPT,CL,XM,CDRG09,IERR)
      IPT (1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD412,IORDER,IPT,CL,XM,CDRG12,IERR)
      CD=CDRG09+(CDRG12-CDRG09)*((TR-.09)/(.12-.09))
      GO TO 250
   41 CALL IBI (5,CLII,26,XMI,5,CD412,IORDER,IPT,CL,XM,CDRG12,IERR)
      IPT (1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD415,IORDER,IPT,CL,XM,CDRG15,IERR)
      CD=CDRG12 + (CDRG15-CDRG12)*((TR-.12)/(.15-.12))
      GO TO 250
   51 CALL IBI (5,CLII,26,XMI,5,CD415,IORDER,IPT,CL,XM,CDRG15,IERR)
      IPT (1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD418,IORDER,IPT,CL,XM,CDRG18,IERR)
      CD=CDRG15+(CDRG18-CDRG15)*((TR-.15)/(.18-.15))
      GO TO 250
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   61 CALL IBI (5,CLII,26,XMI,5,CD418,IORDER,IPT,CL,XM,CDRG18,IERR)
      IPT (1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD421,IORDER,IPT,CL,XM,CDRG21,IERR)
      CD=CDRG18+(CDRG21-CDRG18)*((TR-.18)/(.21-.18))
      GO TO 250
   71 CALL IBI (5,CLII,26,XMI,5,CD421,IORDER,IPT,CL,XM,CDRG21,IERR)
      CD=CDRG21
      IF (TR .GT. .21) WRITE(6,204) TR
  204  FORMAT(*0THICKNESS RATIO=*,F5.3,* IS OUT OF RANGE.
     &*/* THE VALUES FOR T/C=.21 HAVE BEEN RETURNED.*)
  250 IF(CL .GT. .8) GO TO 251
      RETURN
  251 CALL COMPUT(D,XM,ALT,COR,TR,AA,CDT,CL,CD,CLDES)
      CD=CDT
      RETURN
      END



      SUBROUTINE AERO5(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
C
C
C THIS SUBROUTINE IS DESIGNED TO COMPUTE THE AIRFOIL
C CHARACTERISTICS FOR A 16 SERIES AIRFOIL WITH A GIVEN CAMBER.
C
C THIS SUBROUTINE RELATES CL,CD,CL/CD,MACH,T/C,AND ALPHA.
C IT REPRESENTS THE DATA OF A 16-5XX AIRFOIL.
C
C XM=RELATIVE MACH NO. AT BLADE ELEMENT
C AA=ANGLE OF ATTACK IN DEGREES
C IKEY1: CL=CL(MACH,ALPHA,T/C)
C      : CD=CD(MACH,CL,T/C)
C      :XLD=CL/CD
C IKEY2: ALPHA=ALPHA(MACH,CL,T/C)
C      : CD=CD(MACH,CL,T/C)
C      :XLD=CL/CD
C TR=T/C
C
C
C
C
      DIMENSION IORDER(2),IPT(2),ALP504(26,9),ALP506(26,9),
     & ALP509(26,9),ALP512(26,9),ALP515(26,9),ALP518(26,9),
     & ALP521(26,9),CLI(9),XMI(26),ALPI(7),CL504(7,26),
     & CL506(7,26),CL509(7,26),CL512(7,26),CL515(7,26),
     & CL518(7,26),CL521(7,26),CD504(5,26),CD506(5,26),
     & CD509(5,26),CD512(5,26),CD515(5,26),CD518(5,26),
     & CD521(5,26),CLII(5)
      DATA((CL504(I,J),J=1,26),I=1,4)/
     1 -.046, -.056, -.062, -.067, -.072, -.075, -.078, -.081, -.082,
     1 -.082, -.077, -.068, -.059, -.053, -.084, -.163, -.277, -.327,
     1 -.289, -.248, -.213, -.195, -.223, -.284, -.302, -.302,
     2  .177,  .185,  .199,  .210,  .225,  .233,  .241,  .249,  .263,
     2  .278,  .292,  .307,  .310,  .269,  .177,  .086,  .004, -.009,
     2  .028,  .074,  .112,  .121,  .096, -.041, -.138, -.154,
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3  .407,  .431,  .453,  .464,  .478,  .485,  .492,  .499,  .509,
3  .519,  .530,  .539,  .529,  .469,  .396,  .322,  .256,  .230,
3  .259,  .306,  .345,  .354,  .328,  .148,  .012, -.033,
4  .620,  .651,  .676,  .693,  .709,  .717,  .730,  .742,  .754,
4  .770,  .779,  .767,  .728,  .665,  .602,  .539,  .482,  .449,
4  .479,  .528,  .573,  .586,  .550,  .314,  .139,  .075/
 DATA((CL504(I,J),J=1,26),I=5,7)/
5  .755,  .807,  .845,  .871,  .898,  .916,  .935,  .954,  .974,
5  .996, 1.000,  .973,  .920,  .866,  .812,  .759,  .711,  .687,
5  .723,  .775,  .820,  .828,  .788,  .477,  .265,  .182,
6  .912,  .971, 1.016, 1.042, 1.069, 1.086, 1.102, 1.119, 1.134,
6 1.141, 1.118, 1.078, 1.037,  .995,  .953,  .911,  .869,  .848,
6  .880,  .923,  .967,  .985,  .946,  .614,  .389,  .290,
7 1.069, 1.123, 1.163, 1.192, 1.229, 1.256, 1.273, 1.289, 1.307,
7 1.289, 1.250, 1.212, 1.169, 1.126, 1.083, 1.040, 1.002,  .983,
7 1.022, 1.074, 1.115, 1.127, 1.089,  .757,  .512,  .406/
 DATA((CL506(I,J),J=1,26),I=1,4)/
1  .002, -.006, -.018, -.026, -.037, -.043, -.050, -.064, -.088,
1 -.121, -.168, -.216, -.273, -.339, -.406, -.472, -.486, -.440,
1 -.383, -.326, -.315, -.315, -.316, -.316, -.317, -.318,
2  .210,  .214,  .221,  .224,  .235,  .240,  .244,  .248,  .248,
2  .242,  .212,  .146,  .069, -.008, -.084, -.160, -.185, -.146,
2 -.092, -.038, -.021, -.039, -.047, -.090, -.118, -.123,
3  .413,  .446,  .474,  .489,  .504,  .513,  .524,  .534,  .544,
3  .554,  .537,  .463,  .384,  .304,  .225,  .146,  .125,  .166,
3  .223,  .278,  .287,  .266,  .240,  .099,  .008, -.012,
4  .625,  .667,  .697,  .713,  .731,  .742,  .754,  .766,  .778,
4  .751,  .717,  .664,  .612,  .539,  .462,  .392,  .377,  .414,
4  .469,  .522,  .532,  .503,  .466,  .249,  .119,  .093/
 DATA((CL506(I,J),J=1,26),I=5,7)/
5  .746,  .804,  .847,  .873,  .910,  .929,  .951,  .974,  .963,
5  .924,  .868,  .812,  .756,  .700,  .644,  .596,  .579,  .610,
5  .665,  .718,  .738,  .704,  .655,  .392,  .246,  .206,
6  .906,  .964, 1.010, 1.039, 1.070, 1.091, 1.105, 1.091, 1.054,
6 1.006,  .959,  .911,  .863,  .815,  .768,  .723,  .709,  .746,
6  .798,  .847,  .867,  .836,  .793,  .535,  .375,  .313,
7 1.052, 1.115, 1.164, 1.203, 1.229, 1.221, 1.207, 1.180, 1.148,
7 1.106, 1.065, 1.023,  .981,  .940,  .900,  .862,  .858,  .904,
7  .959, 1.013, 1.020,  .985,  .937,  .682,  .517,  .428/
 DATA((CL509(I,J),J=1,26),I=1,4)/
1  .018,  .016,  .015,  .015,  .015,  .017,  .024,  .011, -.029,
1 -.078, -.135, -.203, -.271, -.346, -.428, -.458, -.392, -.298,
1 -.228, -.224, -.229, -.235, -.240, -.274, -.295, -.296,
2  .233,  .254,  .268,  .277,  .285,  .297,  .310,  .320,  .308,
2  .276,  .196,  .110, -.000, -.137, -.237, -.236, -.168, -.084,
2 -.041, -.044, -.057, -.069, -.079, -.120, -.142, -.158,
3  .435,  .457,  .468,  .483,  .499,  .506,  .514,  .520,  .519,
3  .490,  .404,  .287,  .170,  .053, -.027, -.019,  .032,  .102,
3  .155,  .159,  .145,  .133,  .121,  .054,  .003, -.035,
4  .605,  .642,  .672,  .688,  .712,  .723,  .735,  .736,  .707,
4  .616,  .522,  .429,  .335,  .241,  .194,  .204,  .264,  .338,
4  .378,  .372,  .357,  .341,  .325,  .226,  .149,  .090/
 DATA((CL509(I,J),J=1,26),I=5,7)/
5  .749,  .806,  .849,  .870,  .895,  .908,  .893,  .863,  .789,
5  .714,  .640,  .565,  .490,  .416,  .366,  .375,  .434,  .508,
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5  .552,  .548,  .529,  .510,  .490,  .371,  .278,  .190,
6  .870,  .932,  .988, 1.018, 1.054, 1.046, 1.027,  .962,  .896,
6  .830,  .764,  .699,  .633,  .567,  .534,  .539,  .604,  .686,
6  .713,  .697,  .677,  .655,  .634,  .503,  .400,  .301,
7 1.001, 1.052, 1.110, 1.158, 1.159, 1.137, 1.102, 1.043,  .984,
7  .925,  .866,  .807,  .748,  .689,  .644,  .663,  .732,  .813,
7  .836,  .824,  .801,  .778,  .754,  .618,  .505,  .409/
 DATA((CL512(I,J),J=1,26),I=1,4)/
1  .014,  .012,  .013,  .016,  .020,  .021,  .014, -.013, -.068,
1 -.166, -.273, -.387, -.510, -.547, -.520, -.404, -.259, -.210,
1 -.210, -.211, -.212, -.213, -.215, -.225, -.238, -.252,
2  .195,  .210,  .224,  .234,  .245,  .247,  .235,  .211,  .154,
2  .074, -.025, -.162, -.327, -.403, -.364, -.236, -.122, -.088,
2 -.089, -.091, -.092, -.094, -.095, -.105, -.116, -.128,
3  .363,  .383,  .399,  .407,  .418,  .426,  .433,  .418,  .373,
3  .268,  .152, -.011, -.157, -.192, -.147, -.057,  .023,  .049,
3  .042,  .029,  .021,  .017,  .012, -.013, -.024, -.029,
4  .537,  .572,  .600,  .614,  .628,  .631,  .622,  .568,  .475,
4  .382,  .288,  .167,  .050,  .005,  .045,  .134,  .234,  .255,
4  .245,  .235,  .226,  .216,  .206,  .156,  .113,  .086/
 DATA((CL512(I,J),J=1,26),I=5,7)/
5  .691,  .732,  .761,  .781,  .795,  .782,  .743,  .658,  .567,
5  .477,  .386,  .295,  .214,  .184,  .222,  .307,  .391,  .423,
5  .415,  .403,  .390,  .377,  .364,  .294,  .239,  .193,
6  .804,  .862,  .915,  .950,  .958,  .921,  .859,  .780,  .701,
6  .622,  .543,  .465,  .393,  .347,  .390,  .483,  .574,  .599,
6  .585,  .570,  .556,  .542,  .528,  .441,  .362,  .305,
7  .913,  .976, 1.041, 1.075, 1.052, 1.012,  .958,  .882,  .799,
7  .717,  .635,  .553,  .478,  .449,  .493,  .594,  .683,  .696,
7  .683,  .669,  .655,  .641,  .627,  .545,  .474,  .412/
 DATA((CL515(I,J),J=1,26),I=1,4)/
1  .028,  .041,  .048,  .051,  .053,  .043,  .001, -.069, -.177,
1 -.308, -.467, -.540, -.561, -.525, -.466, -.386, -.324, -.304,
1 -.302, -.301, -.301, -.301, -.300, -.298, -.297, -.295,
2  .155,  .179,  .192,  .201,  .206,  .189,  .155,  .097, -.005,
2 -.177, -.343, -.430, -.446, -.416, -.342, -.257, -.211, -.202,
2 -.200, -.200, -.199, -.199, -.198, -.195, -.200, -.207,
3  .312,  .321,  .326,  .329,  .335,  .329,  .309,  .255,  .185,
3  .044, -.102, -.308, -.352, -.299, -.195, -.085, -.057, -.054,
3 -.051, -.049, -.046, -.044, -.041, -.041, -.039, -.037,
4  .492,  .510,  .524,  .533,  .543,  .525,  .496,  .413,  .328,
4  .193,  .041, -.124, -.145, -.085,  .034,  .137,  .157,  .154,
4  .150,  .145,  .140,  .136,  .131,  .106,  .085,  .073/
 DATA((CL515(I,J),J=1,26),I=5,7)/
5  .636,  .666,  .681,  .694,  .689,  .664,  .605,  .532,  .423,
5  .314,  .205,  .090,  .066,  .113,  .230,  .328,  .357,  .349,
5  .342,  .334,  .327,  .319,  .312,  .266,  .220,  .187,
6  .734,  .779,  .813,  .836,  .822,  .771,  .719,  .616,  .507,
6  .397,  .288,  .176,  .164,  .216,  .329,  .428,  .455,  .448,
6  .440,  .432,  .424,  .416,  .408,  .360,  .328,  .295,
7  .835,  .871,  .919,  .960,  .930,  .865,  .792,  .719,  .620,
7  .492,  .364,  .253,  .233,  .286,  .395,  .496,  .526,  .524,
7  .517,  .509,  .502,  .494,  .486,  .443,  .407,  .374/
 DATA((CL518(I,J),J=1,26),I=1,4)/
1 -.054, -.054, -.060, -.070, -.124, -.203, -.307, -.425, -.538,
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1 -.628, -.704, -.754, -.760, -.724, -.620, -.483, -.424, -.422,
1 -.422, -.422, -.422, -.422, -.421, -.421, -.420, -.419,
2  .098,  .101,  .107,  .119,  .077,  .004, -.103, -.239, -.375,
2 -.499, -.580, -.629, -.613, -.541, -.433, -.322, -.304, -.303,
2 -.303, -.302, -.302, -.302, -.301, -.299, -.296, -.294,
3  .249,  .261,  .272,  .278,  .222,  .157,  .061, -.049, -.182,
3 -.351, -.475, -.503, -.462, -.330, -.199, -.151, -.147, -.146,
3 -.147, -.148, -.148, -.149, -.150, -.152, -.149, -.146,
4  .424,  .436,  .449,  .456,  .397,  .310,  .223,  .120, -.002,
4 -.132, -.262, -.310, -.285, -.139,  .000,  .045,  .045,  .043,
4  .038,  .034,  .029,  .024,  .020,  .007, -.005, -.018/
 DATA((CL518(I,J),J=1,26),I=5,7)/
5  .565,  .585,  .606,  .607,  .552,  .484,  .407,  .307,  .196,
5  .004, -.086, -.126, -.094,  .060,  .193,  .235,  .229,  .223,
5  .217,  .211,  .206,  .200,  .195,  .162,  .130,  .097,
6  .674,  .708,  .754,  .766,  .661,  .572,  .480,  .387,  .276,
6  .161,  .071,  .023,  .062,  .266,  .395,  .435,  .424,  .414,
6  .404,  .394,  .384,  .374,  .364,  .309,  .257,  .209,
7  .779,  .824,  .892,  .895,  .767,  .672,  .573,  .455,  .321,
7  .200,  .104,  .067,  .102,  .306,  .443,  .482,  .473,  .461,
7  .450,  .439,  .428,  .417,  .406,  .349,  .292,  .242/
 DATA((CL521(I,J),J=1,26),I=1,4)/
1 -.102, -.085, -.069, -.063, -.070, -.181, -.322, -.463, -.603,
1 -.744, -.789, -.758, -.644, -.471, -.393, -.361, -.369, -.377,
1 -.384, -.392, -.400, -.405, -.409, -.429, -.438, -.436,
2  .048,  .070,  .081,  .083,  .065, -.045, -.199, -.352, -.505,
2 -.605, -.644, -.582, -.442, -.302, -.229, -.221, -.229, -.237,
2 -.245, -.251, -.257, -.263, -.269, -.298, -.306, -.315,
3  .169,  .188,  .207,  .221,  .207,  .128, -.025, -.177, -.330,
3 -.447, -.493, -.454, -.297, -.155, -.111, -.115, -.121, -.127,
3 -.133, -.140, -.146, -.152, -.158, -.184, -.202, -.211,
4  .329,  .350,  .370,  .381,  .352,  .268,  .106, -.055, -.216,
4 -.349, -.394, -.362, -.203, -.052, -.008, -.013, -.018, -.024,
4 -.029, -.034, -.040, -.045, -.051, -.084, -.102, -.119/
 DATA((CL521(I,J),J=1,26),I=5,7)/
5  .486,  .499,  .519,  .533,  .492,  .403,  .259,  .115, -.029,
5 -.141, -.189, -.143, -.003,  .145,  .187,  .186,  .178,  .170,
5  .162,  .154,  .146,  .137,  .129,  .092,  .063,  .037,
6  .578,  .609,  .640,  .653,  .588,  .464,  .332,  .199,  .067,
6 -.044, -.090, -.058,  .111,  .248,  .298,  .292,  .284,  .276,
6  .268,  .260,  .253,  .245,  .237,  .194,  .172,  .149,
7  .686,  .737,  .781,  .778,  .669,  .531,  .392,  .254,  .115,
7  .015, -.027,  .014,  .175,  .313,  .352,  .348,  .338,  .328,
7  .319,  .311,  .304,  .297,  .290,  .252,  .230,  .207/
 DATA((ALP504(J,N),N=1,9),J=1,13)/
& -7.17, -5.38, -3.59, -1.80,  -.06,  1.81,  4.57,  7.12,  9.67,
& -6.85, -5.20, -3.54, -1.88,  -.25,  1.54,  3.91,  6.38,  9.01,
& -6.59, -5.06, -3.52, -1.99,  -.42,  1.32,  3.47,  5.81,  8.50,
& -6.40, -4.96, -3.52, -2.07,  -.50,  1.19,  3.20,  5.51,  8.11,
& -6.21, -4.86, -3.52, -2.17,  -.62,  1.06,  2.96,  5.19,  7.64,
& -6.11, -4.81, -3.51, -2.21,  -.67,   .99,  2.83,  4.99,  7.34,
& -6.02, -4.76, -3.51, -2.26,  -.73,   .91,  2.68,  4.78,  7.15,
& -5.93, -4.72, -3.51, -2.30,  -.79,   .83,  2.55,  4.56,  6.95,
& -5.84, -4.68, -3.52, -2.37,  -.89,   .74,  2.42,  4.33,  6.76,
& -5.77, -4.66, -3.54, -2.43,  -.99,   .65,  2.27,  4.06,  6.80,
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     & -5.75, -4.67, -3.58, -2.50, -1.09,   .56,  2.19,  4.00,  7.24,
     & -5.77, -4.70, -3.64, -2.57, -1.20,   .54,  2.32,  4.51,  7.82,
     & -5.85, -4.76, -3.68, -2.60, -1.18,   .71,  2.75,  5.37,  8.47/
      DATA((ALP504(J,N),N=1,9),J=14,26)/
     & -6.16, -4.91, -3.67, -2.43,  -.69,  1.34,  3.34,  6.08,  9.13,
     & -6.42, -4.89, -3.36, -1.79,   .04,  1.98,  3.89,  6.72,  9.80,
     & -5.90, -4.30, -2.69, -1.03,   .72,  2.55,  4.54,  7.38, 10.48,
     & -4.88, -3.45, -2.03,  -.44,  1.27,  3.03,  5.13,  7.97, 10.98,
     & -4.46, -3.20, -1.92,  -.25,  1.55,  3.27,  5.40,  8.25, 11.21,
     & -4.70, -3.44, -2.18,  -.51,  1.28,  2.99,  4.98,  7.69, 10.51,
     & -4.94, -3.70, -2.46,  -.91,   .85,  2.58,  4.34,  7.02,  9.67,
     & -5.15, -3.92, -2.69, -1.24,   .48,  2.22,  3.84,  6.45,  9.15,
     & -5.30, -4.03, -2.77, -1.32,   .40,  2.12,  3.77,  6.21,  9.03,
     & -5.11, -3.86, -2.60, -1.10,   .65,  2.42,  4.15,  6.76,  9.55,
     & -4.95, -3.31, -1.57,   .63,  3.06,  5.80,  8.60, 11.40, 14.20,
     & -5.20, -2.76,  -.16,  2.97,  6.18,  9.43, 12.68, 15.93, 19.19,
     & -5.32, -2.62,   .61,  4.33,  7.90, 11.34, 14.79, 18.24, 21.69/
      DATA((ALP506(J,N),N=1,9),J=1,13)/
     & -7.87, -5.94, -4.02, -2.10,  -.13,  1.76,  4.68,  7.29, 10.03,
     & -7.58, -5.76, -3.95, -2.13,  -.40,  1.39,  3.94,  6.48,  9.13,
     & -7.20, -5.52, -3.85, -2.18,  -.58,  1.13,  3.37,  5.88,  8.47,
     & -6.99, -5.39, -3.79, -2.19,  -.67,   .99,  3.09,  5.53,  7.96,
     & -6.67, -5.20, -3.73, -2.26,  -.77,   .85,  2.77,  5.13,  7.64,
     & -6.52, -5.11, -3.70, -2.28,  -.83,   .76,  2.62,  4.88,  7.68,
     & -6.38, -5.02, -3.66, -2.30,  -.89,   .66,  2.47,  4.64,  7.86,
     & -6.15, -4.87, -3.59, -2.31,  -.94,   .57,  2.33,  4.44,  8.45,
     & -5.86, -4.67, -3.48, -2.29,  -.97,   .48,  2.24,  4.81,  9.11,
     & -5.54, -4.44, -3.33, -2.23,  -.99,   .47,  2.57,  5.85,  9.88,
     & -5.22, -4.17, -3.12, -2.06,  -.84,   .70,  3.10,  6.77, 10.55,
     & -5.02, -3.91, -2.81, -1.66,  -.40,  1.36,  3.84,  7.59, 11.16,
     & -4.74, -3.57, -2.40, -1.17,   .14,  1.89,  4.82,  8.32, 11.71/
      DATA((ALP506(J,N),N=1,9),J=14,26)/
     & -4.37, -3.16, -1.95,  -.67,   .82,  2.76,  5.74,  8.96, 12.16,
     & -3.96, -2.72, -1.46,  -.16,  1.48,  3.52,  6.48,  9.52, 12.55,
     & -3.54, -2.26,  -.95,   .44,  2.08,  4.06,  7.11,  9.99, 12.86,
     & -3.43, -2.10,  -.81,   .60,  2.23,  4.32,  7.22,  9.91, 12.59,
     & -3.73, -2.37, -1.06,   .27,  1.89,  3.90,  6.68,  9.22, 11.75,
     & -4.12, -2.74, -1.42,  -.15,  1.44,  3.34,  6.02,  8.51, 10.99,
     & -4.51, -3.13, -1.76,  -.49,  1.00,  2.80,  5.27,  7.84, 10.25,
     & -4.58, -3.22, -1.86,  -.56,   .92,  2.66,  4.96,  7.74, 10.35,
     & -4.62, -3.17, -1.74,  -.43,  1.13,  2.97,  5.45,  8.20, 10.89,
     & -4.62, -3.14, -1.67,  -.28,  1.42,  3.42,  6.10,  8.88, 11.65,
     & -4.74, -2.97, -1.05,  1.35,  4.11,  6.88,  9.61, 12.33, 15.05,
     & -4.83, -2.82,  -.13,  3.28,  6.35,  9.17, 11.99, 14.80, 17.62,
     & -4.84, -2.79,   .23,  3.89,  7.51, 10.99, 14.47, 17.95, 21.43/
      DATA((ALP509(J,N),N=1,9),J=1,13)/
     & -7.89, -6.03, -4.17, -2.31,  -.35,  1.94,  4.84,  7.98, 11.04,
     & -7.50, -5.82, -4.13, -2.45,  -.56,  1.55,  3.93,  7.13, 10.47,
     & -7.28, -5.70, -4.12, -2.54,  -.68,  1.29,  3.45,  6.20,  9.48,
     & -7.17, -5.64, -4.11, -2.59,  -.81,  1.14,  3.23,  5.76,  8.60,
     & -7.07, -5.59, -4.11, -2.63,  -.93,   .95,  2.96,  5.32,  8.78,
     & -6.98, -5.55, -4.12, -2.69, -1.01,   .87,  2.83,  5.33,  9.38,
     & -6.97, -5.57, -4.17, -2.77, -1.12,   .78,  2.82,  5.60, 10.61,
     & -6.66, -5.37, -4.07, -2.78, -1.20,   .74,  3.01,  6.94, 11.88,
     & -6.20, -5.01, -3.83, -2.64, -1.13,   .86,  4.21,  8.36, 12.91,
```

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& -5.82, -4.69, -3.56, -2.43,  -.84,  1.75,  5.48,  9.58, 13.79,
& -5.60, -4.39, -3.18, -1.96,  -.04,  3.32,  6.71, 10.63, 14.55,
& -5.26, -3.98, -2.70,  -.98,  1.59,  4.52,  7.87, 11.57, 15.28,
& -4.95, -3.48, -2.00,   .36,  2.84,  5.54,  8.90, 12.38, 15.86/
 DATA((ALP509(J,N),N=1,9),J=14,26)/
& -4.52, -2.60,  -.56,  1.56,  3.82,  6.54,  9.82, 13.10, 16.38,
& -3.71, -1.65,   .24,  2.07,  4.40,  7.20, 10.84, 14.47, 18.11,
& -3.48, -1.67,   .17,  1.96,  4.30,  6.98, 10.21, 13.44, 16.66,
& -4.07, -2.29,  -.32,  1.45,  3.60,  5.95,  9.06, 12.19, 15.31,
& -4.95, -3.08, -1.10,   .83,  2.73,  5.03,  7.80, 10.94, 14.09,
& -5.84, -3.70, -1.58,   .40,  2.25,  4.60,  7.41, 10.67, 13.92,
& -5.96, -3.73, -1.57,   .38,  2.32,  4.70,  7.62, 10.77, 13.92,
& -5.99, -3.66, -1.44,   .52,  2.50,  4.96,  7.98, 11.21, 14.44,
& -5.99, -3.58, -1.32,   .64,  2.70,  5.24,  8.36, 11.61, 14.86,
& -5.99, -3.50, -1.21,   .77,  2.91,  5.53,  8.77, 12.10, 15.43,
& -5.64, -3.04,  -.62,  1.70,  4.44,  7.69, 11.17, 14.64, 18.12,
& -5.37, -2.76,  -.04,  2.79,  6.00,  9.81, 13.62, 17.43, 21.24,
& -5.51, -2.61,   .56,  4.18,  7.83, 11.54, 15.24, 18.94, 22.65/
 DATA((ALP512(J,N),N=1,9),J=1,13)/
& -8.57, -6.36, -4.15, -1.94,   .43,  2.82,  5.93,  9.60, 13.27,
& -8.16, -6.14, -4.12, -2.10,   .18,  2.35,  5.05,  8.42, 11.93,
& -7.91, -6.02, -4.12, -2.23,   .01,  2.00,  4.51,  7.35, 10.52,
& -7.82, -5.98, -4.15, -2.31,  -.08,  1.86,  4.22,  6.80, 10.00,
& -7.73, -5.96, -4.18, -2.40,  -.21,  1.73,  4.06,  6.89, 11.15,
& -7.73, -5.96, -4.19, -2.42,  -.29,  1.70,  4.26,  7.74, 12.13,
& -7.75, -5.94, -4.13, -2.32,  -.33,  1.77,  4.98,  8.85, 12.89,
& -7.46, -5.67, -3.88, -2.10,  -.17,  2.71,  6.39, 10.31, 14.24,
& -6.99, -5.19, -3.39, -1.58,   .53,  4.49,  8.02, 12.10, 16.18,
& -5.95, -4.28, -2.62,  -.70,  2.38,  5.70,  9.75, 13.96, 18.17,
& -5.02, -3.41, -1.72,   .71,  4.18,  7.24, 11.59, 15.93, 20.28,
& -4.12, -2.34,   .12,  2.52,  5.24,  9.07, 13.61, 18.16, 22.70,
& -2.80,  -.51,  1.52,  3.83,  6.16, 10.87, 15.58, 20.28, 24.99/
 DATA((ALP512(J,N),N=1,9),J=14,26)/
& -1.97,  -.08,  1.95,  4.20,  7.04, 10.96, 14.88, 18.80, 22.73,
& -2.46,  -.49,  1.53,  3.75,  6.19, 10.08, 13.96, 17.84, 21.73,
& -3.95, -1.60,   .60,  2.76,  5.06,  8.11, 11.71, 15.32, 18.92,
& -6.06, -3.14,  -.32,  1.68,  4.10,  6.48, 10.15, 13.82, 17.49,
& -7.11, -3.84,  -.72,  1.47,  3.73,  6.02, 10.14, 14.27, 18.39,
& -7.14, -3.83,  -.64,  1.56,  3.82,  6.31, 10.39, 14.47, 18.55,
& -7.15, -3.82,  -.48,  1.66,  3.96,  6.61, 10.65, 14.69, 18.73,
& -7.13, -3.80,  -.37,  1.75,  4.12,  6.89, 10.93, 14.97, 19.01,
& -7.14, -3.78,  -.31,  1.84,  4.28,  7.17, 11.21, 15.25, 19.29,
& -7.08, -3.75,  -.22,  1.94,  4.44,  7.45, 11.49, 15.54, 19.58,
& -6.92, -3.58,   .15,  2.64,  5.44,  9.06, 12.90, 16.75, 20.60,
& -6.66, -3.38,   .35,  3.38,  6.68, 10.25, 13.82, 17.39, 20.96,
& -6.39, -3.16,   .50,  4.13,  7.78, 11.51, 15.25, 18.99, 22.73/
 DATA((ALP515(J,N),N=1,9),J=1,13)/
&-10.74, -7.59, -4.44, -1.43,   .98,  3.50,  7.31, 11.27, 15.23,
&-10.39, -7.49, -4.59, -1.70,   .84,  3.15,  6.46, 10.80, 15.15,
&-10.22, -7.44, -4.67, -1.88,   .75,  2.97,  5.80,  9.53, 13.30,
&-10.01, -7.35, -4.68, -2.01,   .70,  2.83,  5.49,  8.65, 11.87,
& -9.92, -7.31, -4.69, -2.08,   .63,  2.78,  5.67,  9.30, 13.00,
&-10.07, -7.33, -4.59, -1.84,   .72,  3.08,  6.62, 10.87, 15.13,
& -9.21, -6.61, -4.01, -1.42,   .97,  3.91,  8.22, 13.70, 19.18,
& -7.99, -5.58, -3.17,  -.70,  1.84,  5.62,  9.57, 13.46, 17.34,
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& -6.59, -4.27, -1.95,   .21,  3.52,  7.65, 11.19, 14.73, 18.27,
& -5.40, -2.35,  -.40,  2.12,  6.06, 10.27, 14.48, 18.69, 22.91,
& -2.92,  -.81,  1.43,  3.94,  8.95, 14.21, 19.47, 24.74, 30.00,
& -1.51,  1.17,  3.16,  6.62, 11.82, 17.01, 22.21, 27.40, 32.60,
& -1.02,  1.47,  3.37,  7.04, 12.84, 18.64, 24.43, 30.23, 36.03/
 DATA((ALP515(J,N),N=1,9),J=14,26)/
& -1.73,   .93,  2.86,  5.69, 11.26, 16.97, 22.69, 28.40, 34.11,
& -2.94,  -.07,  1.70,  3.69,  8.15, 14.21, 20.27, 26.33, 32.39,
& -4.22, -1.34,   .77,  2.66,  5.44, 11.06, 16.94, 22.82, 28.71,
& -5.35, -1.86,   .53,  2.43,  4.88, 10.08, 15.72, 21.35, 26.99,
& -5.88, -1.97,   .52,  2.47,  5.03, 10.00, 15.26, 20.53, 25.79,
& -5.92, -2.00,   .51,  2.52,  5.18, 10.16, 15.35, 20.55, 25.74,
& -5.96, -2.00,   .51,  2.58,  5.35, 10.36, 15.56, 20.75, 25.95,
& -5.94, -2.02,   .49,  2.64,  5.51, 10.51, 15.64, 20.77, 25.90,
& -5.94, -2.02,   .49,  2.70,  5.67, 10.72, 15.85, 20.97, 26.10,
& -5.96, -2.04,   .48,  2.76,  5.83, 10.92, 16.05, 21.18, 26.31,
& -5.98, -2.10,   .56,  3.18,  6.96, 11.78, 16.60, 21.42, 26.24,
& -6.12, -2.00,   .63,  3.70,  7.82, 12.89, 17.95, 23.01, 28.08,
& -6.39, -1.92,   .67,  4.24,  8.66, 13.72, 18.78, 23.85, 28.91/
 DATA((ALP518(J,N),N=1,9),J=1,13)/
& -8.55, -5.92, -3.29,  -.65,  1.73,  4.64,  8.40, 12.21, 16.02,
& -8.46, -5.88, -3.30,  -.76,  1.59,  4.24,  7.59, 11.03, 14.48,
& -8.07, -5.68, -3.28,  -.87,  1.45,  3.92,  6.67,  9.57, 12.46,
& -7.49, -5.38, -3.26,  -.98,  1.37,  3.91,  6.53,  9.63, 12.73,
& -6.75, -4.76, -2.77,  -.30,  2.04,  4.88,  8.62, 12.40, 16.17,
& -5.90, -3.97, -2.04,   .56,  3.03,  6.56, 10.56, 14.56, 18.56,
& -4.91, -2.95,  -.74,  1.72,  3.92,  8.58, 12.88, 17.18, 21.48,
& -3.73, -1.59,   .58,  2.86,  6.38, 12.26, 18.15, 24.03, 29.91,
& -2.31,  -.19,  2.02,  4.10, 11.51, 20.40, 29.29, 38.18, 47.07,
&  -.66,  1.38,  3.94,  8.00, 18.26, 28.51, 38.77, 49.03, 59.28,
&   .70,  2.70,  5.10, 13.82, 25.94, 38.06, 50.18, 62.30, 74.42,
&  1.07,  3.20,  5.69, 14.05, 23.14, 32.23, 41.32, 50.41, 59.50,
&   .70,  2.89,  5.21, 12.90, 22.90, 32.90, 42.90, 52.90, 62.90/
 DATA((ALP518(J,N),N=1,9),J=14,26)/
&  -.66,  1.36,  3.40,  5.36, 12.70, 22.70, 32.70, 42.70, 52.70,
& -1.72,  -.01,  2.00,  4.07,  6.21, 14.54, 22.88, 31.21, 39.54,
& -2.97,  -.57,  1.54,  3.63,  5.65, 13.02, 21.53, 30.04, 38.55,
& -3.60,  -.68,  1.53,  3.68,  5.75, 13.18, 21.35, 29.51, 37.67,
& -3.63,  -.69,  1.54,  3.74,  5.85, 13.91, 22.43, 30.94, 39.45,
& -3.63,  -.68,  1.59,  3.81,  5.96, 14.52, 23.22, 31.91, 40.61,
& -3.63,  -.68,  1.63,  3.88,  6.27, 15.16, 24.04, 32.93, 41.82,
& -3.63,  -.68,  1.67,  3.93,  6.73, 15.82, 24.91, 34.00, 43.09,
& -3.63,  -.67,  1.72,  4.00,  7.21, 16.51, 25.81, 35.12, 44.42,
& -3.65,  -.66,  1.76,  4.06,  7.71, 17.24, 26.76, 36.29, 45.81,
& -3.66,  -.65,  1.91,  4.52, 10.55, 20.55, 30.55, 40.55, 50.55,
& -3.68,  -.69,  2.07,  5.10, 14.17, 25.60, 37.03, 48.46, 59.89,
& -3.70,  -.73,  2.31,  5.84, 17.58, 29.70, 41.82, 53.94, 66.06/
 DATA((ALP521(J,N),N=1,9),J=1,13)/
& -7.97, -5.31, -2.64,   .39,  2.90,  6.41, 10.11, 13.81, 17.52,
& -8.06, -5.48, -2.90,   .15,  2.67,  5.84,  8.98, 12.11, 15.23,
& -8.41, -5.75, -3.08,  -.11,  2.40,  5.34,  8.27, 11.11, 13.94,
& -8.62, -5.88, -3.14,  -.30,  2.25,  5.12,  8.35, 11.55, 14.75,
& -8.89, -5.93, -2.96,  -.10,  2.69,  6.30, 11.23, 16.17, 21.11,
& -7.22, -4.28, -1.48,  1.03,  3.96, 10.06, 16.03, 22.00, 27.97,
& -5.27, -2.02,   .38,  3.23,  8.27, 14.93, 21.60, 28.27, 34.93,
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     & -2.86,  -.26,  2.65,  6.04, 13.31, 20.58, 27.85, 35.13, 42.40,
     &  -.80,  2.17,  4.60, 11.54, 19.88, 28.21, 36.54, 44.88, 53.21,
     &   .96,  3.43,  7.49, 14.27, 21.05, 27.83, 34.61, 41.39, 48.17,
     &  1.88,  3.89,  8.86, 15.21, 21.56, 27.90, 34.25, 40.60, 46.95,
     &  1.17,  3.48,  7.61, 13.17, 18.72, 24.28, 29.83, 35.39, 40.94,
     & -1.42,  2.03,  4.05,  8.78, 15.03, 21.28, 27.53, 33.78, 40.03/
      DATA((ALP521(J,N),N=1,9),J=14,26)/
     & -3.16,  -.61,  2.53,  5.07, 10.68, 16.83, 22.98, 29.14, 35.29,
     & -4.09, -1.51,  2.08,  4.23,  9.78, 17.19, 24.59, 32.00, 39.41,
     & -4.56, -1.60,  2.13,  4.26,  9.86, 17.00, 24.14, 31.29, 38.43,
     & -4.44, -1.46,  2.18,  4.42, 10.30, 17.70, 25.11, 32.52, 39.93,
     & -4.33, -1.33,  2.25,  4.57, 10.77, 18.46, 26.15, 33.85, 41.54,
     & -4.23, -1.20,  2.30,  4.72, 11.18, 19.02, 26.86, 34.71, 42.55,
     & -4.11, -1.08,  2.36,  4.87, 11.49, 19.33, 27.18, 35.02, 42.86,
     & -4.00,  -.97,  2.43,  5.01, 11.76, 19.61, 27.45, 35.29, 43.14,
     & -3.93,  -.86,  2.49,  5.17, 11.96, 19.65, 27.35, 35.04, 42.73,
     & -3.87,  -.76,  2.57,  5.31, 12.15, 19.70, 27.25, 34.79, 42.34,
     & -3.56,  -.28,  2.95,  6.21, 13.10, 20.00, 26.90, 33.79, 40.69,
     & -3.42,   .04,  3.24,  6.97, 13.86, 20.76, 27.66, 34.55, 41.45,
     & -3.40,   .24,  3.53,  7.76, 14.66, 21.55, 28.45, 35.34, 42.24/
      DATA((CD504(I,J),J=1,26),I=1,5)/
     1 .0164, .0173, .0177, .0179, .0181, .0182, .0183, .0184, .0186,
     1 .0187, .0190, .0205, .0231, .0282, .0345, .0401, .0445, .0477,
     1 .0501, .0521, .0531, .0541, .0542, .0516, .0401, .0280,
     2 .0093, .0090, .0088, .0088, .0087, .0087, .0087, .0087, .0086,
     2 .0088, .0093, .0118, .0165, .0230, .0293, .0341, .0379, .0407,
     2 .0435, .0451, .0466, .0474, .0482, .0472, .0418, .0346,
     3 .0050, .0050, .0050, .0050, .0050, .0050, .0050, .0050, .0050,
     3 .0051, .0060, .0081, .0125, .0182, .0251, .0313, .0365, .0406,
     3 .0444, .0463, .0481, .0499, .0512, .0583, .0639, .0704,
     4 .0050, .0050, .0050, .0050, .0050, .0050, .0050, .0050, .0050,
     4 .0056, .0066, .0087, .0145, .0215, .0293, .0369, .0440, .0511,
     4 .0571, .0631, .0679, .0720, .0761, .0971, .1108, .1240,
     5 .0123, .0088, .0072, .0069, .0069, .0069, .0070, .0070, .0074,
     5 .0089, .0122, .0190, .0267, .0378, .0492, .0607, .0724, .0838,
     5 .0948, .1057, .1157, .1239, .1322, .1544, .1629, .1672/
      DATA((CD506(I,J),J=1,26),I=1,5)/
     1 .0158, .0157, .0156, .0156, .0155, .0155, .0155, .0155, .0155,
     1 .0158, .0168, .0201, .0252, .0315, .0381, .0445, .0509, .0568,
     1 .0610, .0639, .0666, .0685, .0704, .0645, .0525, .0385,
     2 .0083, .0083, .0083, .0083, .0083, .0083, .0083, .0083, .0084,
     2 .0094, .0114, .0147, .0191, .0243, .0305, .0371, .0435, .0474,
     2 .0514, .0547, .0574, .0601, .0629, .0668, .0590, .0453,
     3 .0055, .0055, .0055, .0055, .0055, .0056, .0056, .0056, .0056,
     3 .0067, .0097, .0126, .0188, .0251, .0320, .0391, .0456, .0512,
     3 .0558, .0592, .0623, .0644, .0666, .0742, .0779, .0779,
     4 .0055, .0055, .0055, .0055, .0055, .0056, .0056, .0056, .0059,
     4 .0077, .0110, .0157, .0212, .0297, .0409, .0505, .0579, .0643,
     4 .0707, .0765, .0818, .0871, .0924, .1106, .1213, .1308,
     5 .0128, .0106, .0094, .0094, .0094, .0094, .0095, .0098, .0149,
     5 .0236, .0323, .0411, .0498, .0585, .0751, .0937, .1085, .1202,
     5 .1311, .1411, .1512, .1605, .1694, .2017, .2196, .2241/
      DATA((CD509(I,J),J=1,26),I=1,5)/
     1 .0141, .0141, .0141, .0141, .0141, .0141, .0141, .0141, .0144,
     1 .0169, .0216, .0262, .0309, .0381, .0454, .0536, .0629, .0715,
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1 .0788, .0853, .0896, .0921, .0940, .0940, .0767, .0541,
2 .0083, .0082, .0081, .0081, .0081, .0081, .0084, .0088, .0100,
2 .0127, .0164, .0210, .0263, .0332, .0404, .0478, .0557, .0634,
2 .0700, .0747, .0776, .0792, .0802, .0791, .0706, .0566,
3 .0058, .0059, .0059, .0059, .0059, .0059, .0061, .0066, .0084,
3 .0121, .0165, .0217, .0276, .0347, .0425, .0511, .0600, .0683,
3 .0749, .0806, .0847, .0873, .0887, .0897, .0890, .0883,
4 .0059, .0059, .0059, .0059, .0059, .0059, .0062, .0068, .0090,
4 .0127, .0169, .0227, .0297, .0388, .0498, .0618, .0759, .0884,
4 .0949, .1003, .1050, .1098, .1136, .1326, .1480, .1616,
5 .0135, .0108, .0090, .0086, .0085, .0085, .0090, .0114, .0162,
5 .0216, .0285, .0374, .0471, .0619, .0766, .0952, .1125, .1257,
5 .1363, .1448, .1513, .1579, .1649, .2024, .2218, .2313/
 DATA((CD512(I,J),J=1,26),I=1,5)/
1 .0137, .0146, .0151, .0153, .0155, .0163, .0191, .0223, .0286,
1 .0371, .0455, .0540, .0670, .0804, .0941, .1053, .1132, .1178,
1 .1216, .1244, .1273, .1301, .1297, .1150, .0970, .0805,
2 .0103, .0103, .0103, .0103, .0103, .0103, .0111, .0145, .0187,
2 .0266, .0354, .0444, .0531, .0619, .0711, .0804, .0896, .0985,
2 .1073, .1150, .1223, .1264, .1293, .1231, .1046, .0872,
3 .0074, .0074, .0075, .0075, .0075, .0078, .0090, .0127, .0172,
3 .0241, .0317, .0406, .0509, .0627, .0738, .0851, .0964, .1077,
3 .1156, .1233, .1309, .1363, .1395, .1378, .1264, .1131,
4 .0074, .0075, .0075, .0075, .0076, .0079, .0089, .0109, .0147,
4 .0218, .0297, .0404, .0522, .0670, .0823, .0984, .1115, .1231,
4 .1339, .1433, .1527, .1605, .1662, .1708, .1676, .1634,
5 .0128, .0126, .0124, .0124, .0126, .0142, .0173, .0238, .0315,
5 .0447, .0609, .0786, .0945, .1102, .1256, .1411, .1533, .1655,
5 .1778, .1895, .2005, .2115, .2225, .2689, .2951, .3213/
 DATA((CD515(I,J),J=1,26),I=1,5)/
1 .0138, .0206, .0240, .0257, .0274, .0283, .0297, .0348, .0444,
1 .0543, .0642, .0751, .0860, .0959, .1049, .1138, .1225, .1312,
1 .1382, .1437, .1491, .1523, .1550, .1502, .1332, .1164,
2 .0103, .0114, .0119, .0126, .0132, .0139, .0166, .0238, .0331,
2 .0435, .0580, .0725, .0841, .0953, .1065, .1173, .1262, .1350,
2 .1431, .1486, .1541, .1587, .1582, .1514, .1369, .1220,
3 .0093, .0094, .0095, .0096, .0098, .0106, .0134, .0209, .0287,
3 .0431, .0575, .0718, .0861, .1003, .1117, .1223, .1329, .1435,
3 .1520, .1574, .1627, .1669, .1691, .1703, .1603, .1515,
4 .0094, .0100, .0104, .0105, .0108, .0119, .0140, .0181, .0276,
4 .0417, .0570, .0739, .0884, .1025, .1166, .1301, .1427, .1552,
4 .1651, .1739, .1827, .1897, .1937, .2040, .2079, .2061,
5 .0138, .0142, .0144, .0149, .0163, .0174, .0243, .0399, .0587,
5 .0793, .1003, .1199, .1391, .1582, .1758, .1933, .2082, .2194,
5 .2306, .2418, .2510, .2583, .2657, .2763, .2728, .2676/
 DATA((CD518(I,J),J=1,26),I=1,5)/
1 .0180, .0223, .0243, .0252, .0261, .0272, .0292, .0389, .0549,
1 .0750, .0911, .1066, .1184, .1274, .1363, .1453, .1505, .1548,
1 .1591, .1633, .1676, .1685, .1683, .1669, .1574, .1470,
2 .0158, .0155, .0153, .0152, .0151, .0161, .0227, .0389, .0586,
2 .0782, .0975, .1141, .1291, .1384, .1477, .1544, .1607, .1670,
2 .1718, .1745, .1772, .1798, .1806, .1787, .1712, .1591,
3 .0137, .0138, .0139, .0140, .0146, .0177, .0237, .0406, .0624,
3 .0831, .1017, .1174, .1306, .1437, .1550, .1629, .1709, .1788,
3 .1840, .1885, .1930, .1975, .2020, .2019, .1922, .1826,
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     4 .0137, .0137, .0144, .0147, .0157, .0181, .0292, .0450, .0651,
     4 .0851, .1036, .1221, .1390, .1543, .1695, .1812, .1910, .2009,
     4 .2108, .2151, .2188, .2225, .2262, .2367, .2356, .2345,
     5 .0197, .0239, .0261, .0273, .0298, .0363, .0572, .0782, .0991,
     5 .1201, .1435, .1721, .1931, .2109, .2287, .2437, .2572, .2707,
     5 .2843, .2913, .2918, .2923, .2927, .2956, .2984, .3012/
      DATA((CD521(I,J),J=1,26),I=1,5)/
     1 .0195, .0227, .0243, .0251, .0264, .0303, .0420, .0591, .0757,
     1 .0925, .1095, .1265, .1435, .1586, .1738, .1889, .2018, .2101,
     1 .2185, .2268, .2301, .2324, .2347, .2388, .2388, .2388,
     2 .0213, .0230, .0239, .0243, .0265, .0351, .0491, .0649, .0808,
     2 .0972, .1136, .1312, .1496, .1673, .1819, .1965, .2097, .2166,
     2 .2236, .2305, .2375, .2443, .2462, .2533, .2545, .2557,
     3 .0155, .0182, .0195, .0201, .0216, .0273, .0451, .0633, .0805,
     3 .0969, .1133, .1327, .1537, .1720, .1865, .2009, .2154, .2291,
     3 .2366, .2441, .2516, .2591, .2666, .2715, .2742, .2769,
     4 .0176, .0201, .0214, .0221, .0250, .0366, .0520, .0690, .0864,
     4 .1047, .1261, .1474, .1687, .1887, .2074, .2260, .2447, .2561,
     4 .2647, .2733, .2818, .2898, .2912, .2993, .2998, .2998,
     5 .0241, .0269, .0283, .0290, .0338, .0517, .0738, .0950, .1188,
     5 .1459, .1730, .1989, .2247, .2472, .2634, .2797, .2960, .3123,
     5 .3239, .3350, .3462, .3471, .3467, .3443, .3420, .3396/
      DATA(XMI(J),J=1,26)/.3,.5,.6,.65,.7,.725,.75,.775,
     & .8,.825,.85,.875,.9,.925,.95,.975,1.0,1.025,1.05,1.075,
     &1.1,1.125,1.15,1.3,1.45,1.6/
      DATA(CLI(J),J=1,9)/-.4,-.2,0.0,.2,.4,.6,.8,1.0,1.2/
      DATA(ALPI(J),J=1,7)/-4.0,-2.0,0.0,2.0,4.0,6.0,8.0/
      DATA(CLII(J),J=1,5)/0.0,.2,.4,.6,.8/
      IORDER(1)=IORDER(2)=1
      IPT (1) = -1
      IF (IKEY .EQ. 2) GO TO 1000
      IF (TR .LT. .04) GO TO 9
      IF (TR .GE. .04 .AND. TR .LT. .06) GO TO 1
      IF (TR .GE. .06 .AND. TR .LT. .09) GO TO 2
      IF (TR .GE. .09 .AND. TR .LT. .12) GO TO 3
      IF (TR .GE. .12 .AND. TR .LT. .15) GO TO 4
      IF (TR .GE. .15 .AND. TR .LT. .18) GO TO 5
      IF (TR .GE. .18 .AND. TR .LT. .21) GO TO 6
      IF (TR .GE. .21) GO TO 7
    9 CALL IBI (7,ALPI,25,XMI,7,CL504,IORDER,IPT,AA,XM,CLFT04,IERR)
      CL=CLFT04
      GO TO 400
    1 CALL IBI (7,ALPI,26,XMI,7,CL504,IORDER,IPT,AA,XM,CLFT04,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL506,IORDER,IPT,AA,XM,CLFT06,IERR)
      CL=CLFT04 + (CLFT06-CLFT04)*((TR-.04)/(.06-.04))
      GO TO 400
    2 CALL IBI (7,ALPI,26,XMI,7,CL506,IORDER,IPT,AA,XM,CLFT06,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL509,IORDER,IPT,AA,XM,CLFT09,IERR)
      CL=CLFT06 + (CLFT09 - CLFT06)*((TR-.06)/(.09-.06))
      GO TO 400
    3 CALL IBI (7,ALPI,26,XMI,7,CL509,IORDER,IPT,AA,XM,CLFT09,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL512,IORDER,IPT,AA,XM,CLFT12,IERR)
```

```
      CL=CLFT09+(CLFT12-CLFT09)*((TR-.09)/(.12-.09))
      GO TO 400
    4 CALL IBI (7,ALPI,26,XMI,7,CL512,IORDER,IPT,AA,XM,CLFT12,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL515,IORDER,IPT,AA,XM,CLFT15,IERR)
      CL=CLFT12 + (CLFT15-CLFT12)*((TR-.12)/(.15-.12))
      GO TO 400
    5 CALL IBI (7,ALPI,26,XMI,7,CL515,IORDER,IPT,AA,XM,CLFT15,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL518,IORDER,IPT,AA,XM,CLFT18,IERR)
      CL=CLFT15+(CLFT18-CLFT15)*((TR-.15)/(.18-.15))
      GO TO 400
    6 CALL IBI (7,ALPI,26,XMI,7,CL518,IORDER,IPT,AA,XM,CLFT18,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL521,IORDER,IPT,AA,XM,CLFT21,IERR)
      CL=CLFT18+(CLFT21-CLFT18)*((TR-.18)/(.21-.18))
      GO TO 400
    7 CALL IBI (7,ALPI,26,XMI,7,CL521,IORDER,IPT,AA,XM,CLFT21,IERR)
      CL=CLFT21
      GO TO 400
 1000 CONTINUE
      IPT (1)=-1
      IF (TR .LT. .04) GO TO 90
      IF (TR .GE. .04 .AND. TR .LT. .06) GO TO 10
      IF (TR .GE. .06 .AND. TR .LT. .09) GO TO 20
      IF (TR .GE. .09 .AND. TR .LT. .12) GO TO 30
      IF (TR .GE. .12 .AND. TR .LT. .15) GO TO 40
      IF (TR .GE. .15 .AND. TR .LT. .18) GO TO 50
      IF (TR .GE. .18 .AND. TR .LT. .21) GO TO 60
      IF (TR .GE. .21) GO TO 70
   90 CALL IBI (26,XMI,9,CLI,26,ALP504,IORDER,IPT,XM,CL,AA04,IERR)
      AA=AA04
      GO TO 400
   10 CALL IBI (26,XMI,9,CLI,26,ALP504,IORDER,IPT,XM,CL,AA04,IERR)
      IPT (1) = -1
      CALL IBI (26,XMI,9,CLI,26,ALP506,IORDER,IPT,XM,CL,AA06,IERR)
      AA=AA04 + (AA06-AA04)*((TR-.04)/(.06-.04))
      GO TO 400
   20 CALL IBI (26,XMI,9,CLI,26,ALP506,IORDER,IPT,XM,CL,AA06,IERR)
      IPT (1) = -1
      CALL IBI (26,XMI,9,CLI,26,ALP509,IORDER,IPT,XM,CL,AA09,IERR)
      AA=AA06 + (AA09 - AA06)*((TR -.06)/(.09-.06))
      GO TO 400
   30 CALL IBI (26,XMI,9,CLI,26,ALP509,IORDER,IPT,XM,CL,AA09,IERR)
      IPT (1) = -1
      CALL IBI (26,XMI,9,CLI,26,ALP512,IORDER,IPT,XM,CL,AA12,IERR)
      AA=AA09+(AA12-AA09)*((TR-.09)/(.12-.09))
      GO TO 400
   40 CALL IBI (26,XMI,9,CLI,26,ALP512,IORDER,IPT,XM,CL,AA12,IERR)
      IPT (1) = -1
      CALL IBI (26,XMI,9,CLI,26,ALP515,IORDER,IPT,XM,CL,AA15,IERR)
      AA=AA12+(AA15-AA12)*((TR-.12)/(.15-.12))
      GO TO 400
   50 CALL IBI (26,XMI,9,CLI,26,ALP515,IORDER,IPT,XM,CL,AA15,IERR)
      IPT (1) = -1
```

```
      CALL IBI (26,XMI,9,CLI,26,ALP518,IORDER,IPT,XM,CL,AA18,IERR)
      AA=AA15+(AA18-AA15)*((TR-.15)/(.18-.15))
      GO TO 400
   60 CALL IBI (26,XMI,9,CLI,26,ALP518,IORDER,IPT,XM,CL,AA18,IERR)
      IPT (1) = -1
      CALL IBI (26,XMI,9,CLI,26,ALP521,IORDER,IPT,XM,CL,AA21,IERR)
      AA=AA18+(AA21-AA18)*((TR-.18)/(.21-.18))
      GO TO 400
   70 CALL IBI (26,XMI,9,CLI,26,ALP521,IORDER,IPT,XM,CL,AA21,IERR)
      AA=AA21
  400 CONTINUE
      IPT (1)=-1
      IF (TR .LT. .04) GO TO 91
      IF (TR .GE. .04 .AND. TR .LT. .06) GO TO 11
      IF (TR .GE. .06 .AND. TR .LT. .09) GO TO 21
      IF (TR .GE. .09 .AND. TR .LT. .12) GO TO 31
      IF (TR .GE. .12 .AND. TR .LT. .15) GO TO 41
      IF (TR .GE. .15 .AND. TR .LT. .18) GO TO 51
      IF (TR .GE. .18 .AND. TR .LT. .21) GO TO 61
      IF (TR .GE. .21) GO TO 71
   91 CALL IBI (5,CLII,26,XMI,5,CD504,IORDER,IPT,CL,XM,CDRG04,IERR)
      CD=CDRG04
      WRITE (6,201) TR
  201  FORMAT(*0THICKNESS RATIO=*,F5.3,* IS OUT OF RANGE.
     &*/* THE VALUES FOR T/C=.04 HAVE BEEN RETURNED*)
      GO TO 250
   11 CALL IBI (5,CLII,26,XMI,5,CD504,IORDER,IPT,CL,XM,CDRG04,IERR)
      IPT (1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD506,IORDER,IPT,CL,XM,CDRG06,IERR)
      CD=CDRG04 + (CDRG06-CDRG04)*((TR-.04)/(.06-.04))
      GO TO 250
   21 CALL IBI (5,CLII,26,XMI,5,CD506,IORDER,IPT,CL,XM,CDRG06,IERR)
      IPT (1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD509,IORDER,IPT,CL,XM,CDRG09,IERR)
      CD=CDRG06 + (CDRG09 - CDRG06)*((TR-.06)/(.09-.06))
      GO TO 250
   31 CALL IBI (5,CLII,26,XMI,5,CD509,IORDER,IPT,CL,XM,CDRG09,IERR)
      IPT (1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD512,IORDER,IPT,CL,XM,CDRG12,IERR)
      CD=CDRG09+(CDRG12-CDRG09)*((TR-.09)/(.12-.09))
      GO TO 250
   41 CALL IBI (5,CLII,26,XMI,5,CD512,IORDER,IPT,CL,XM,CDRG12,IERR)
      IPT (1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD515,IORDER,IPT,CL,XM,CDRG15,IERR)
      CD=CDRG12 + (CDRG15-CDRG12)*((TR-.12)/(.15-.12))
      GO TO 250
   51 CALL IBI (5,CLII,26,XMI,5,CD515,IORDER,IPT,CL,XM,CDRG15,IERR)
      IPT (1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD518,IORDER,IPT,CL,XM,CDRG18,IERR)
      CD=CDRG15+(CDRG18-CDRG15)*((TR-.15)/(.18-.15))
      GO TO 250
   61 CALL IBI (5,CLII,26,XMI,5,CD518,IORDER,IPT,CL,XM,CDRG18,IERR)
      IPT (1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD521,IORDER,IPT,CL,XM,CDRG21,IERR)
      CD=CDRG18+(CDRG21-CDRG18)*((TR-.18)/(.21-.18))
```

```
      GO TO 250
   71 CALL I8I (5,CLII,26,XMI,5,CD521,IORDER,IPT,CL,XM,CDRG21,IERR)
      CD=CDRG21
      IF (TR .GT. .21) WRITE(6,204) TR
  204  FORMAT(*0THICKNESS RATIO=*,F5.3,* IS OUT OF RANGE.
     &*/* THE VALUES FOR T/C=.21 HAVE BEEN RETURNED.*)
  250 IF(CL .GT. .8) GO TO 251
      RETURN
  251 CALL COMPUT(D,XM,ALT,COR,TR,AA,CDT,CL,CD,CLDES)
      CD=CDT
      RETURN
      END


      SUBROUTINE AERO6(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
C
C
C THIS SUBROUTINE IS DESIGNED TO COMPUTE THE AIRFOIL
C CHARACTERISTICS FOR A 16 SERIES AIRFOIL WITH A GIVEN CAMBER.
C
C THIS SUBROUTINE RELATES CL,CD,CL/CD,MACH,T/C,AND ALPHA.
C IT REPRESENTS THE DATA OF A 16-6XX AIRFOIL.
C
C XM=RELATIVE MACH NO. AT BLADE ELEMENT
C AA=ANGLE OF ATTACK IN DEGREES
C IKEY1: CL=CL(MACH,ALPHA,T/C)
C      : CD=CD(MACH,CL,T/C)
C      :XLD=CL/CD
C IKEY2: ALPHA=ALPHA(MACH,CL,T/C)
C      : CD=CD(MACH,CL,T/C)
C      :XLD=CL/CD
C TR=T/C
C
C
C
C
      DIMENSION IORDER(2),IPT(2),ALP604(26,9),ALP606(26,9),
     & ALP609(26,9),ALP612(26,9),ALP615(26,9),
     & CLI(9),XMI(26),ALPI(7),CL604(7,26),
     & CL606(7,26),CL609(7,26),CL612(7,26),CL615(7,26),
     & CD604(5,26),CD606(5,26),
     & CD609(5,26),CD612(5,26),CD615(5,26),CLII(5)
      DATA((CL604(I,J),J=1,26),I=1,4)/
     1  .021,  .021,  .021,  .025,  .030,  .033,  .035,  .040,  .060,
     1  .086,  .111,  .125,  .112,  .052, -.017, -.085, -.154, -.214,
     1 -.202, -.127, -.051, -.018, -.026, -.194, -.263, -.235,
     2  .246,  .259,  .279,  .289,  .305,  .312,  .320,  .328,  .336,
     2  .343,  .351,  .349,  .313,  .254,  .190,  .116,  .037,  .009,
     2  .030,  .098,  .158,  .190,  .174,  .002, -.126, -.149,
     3  .467,  .497,  .523,  .540,  .559,  .569,  .579,  .591,  .603,
     3  .616,  .629,  .616,  .559,  .485,  .404,  .324,  .249,  .214,
     3  .235,  .287,  .352,  .378,  .356,  .172,  .027, -.031,
     4  .673,  .699,  .727,  .742,  .762,  .771,  .781,  .791,  .804,
     4  .818,  .828,  .808,  .739,  .670,  .600,  .530,  .463,  .422,
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4  .455,  .518,  .573,  .595,  .578,  .356,  .163,  .080/
 DATA((CL604(I,J),J=1,26),I=5,7)/
5  .820,  .858,  .895,  .919,  .948,  .968,  .989, 1.010, 1.032,
5 1.042, 1.028,  .997,  .943,  .877,  .812,  .746,  .681,  .663,
5  .699,  .757,  .811,  .830,  .799,  .520,  .298,  .191,
6  .953, 1.016, 1.060, 1.086, 1.121, 1.139, 1.157, 1.175, 1.192,
6 1.190, 1.170, 1.134, 1.078, 1.021,  .965,  .908,  .849,  .824,
6  .859,  .918,  .975, 1.005,  .975,  .655,  .415,  .309,
7 1.114, 1.169, 1.215, 1.239, 1.271, 1.288, 1.304, 1.324, 1.337,
7 1.321, 1.293, 1.254, 1.212, 1.165, 1.109, 1.053,  .993,  .960,
7 1.007, 1.083, 1.148, 1.158, 1.137,  .802,  .547,  .420/
 DATA((CL606(I,J),J=1,26),I=1,4)/
1  .057,  .055,  .060,  .065,  .070,  .072,  .073,  .071,  .044,
1 -.032, -.114, -.197, -.279, -.362, -.444, -.512, -.516, -.485,
1 -.420, -.357, -.336, -.345, -.352, -.361, -.366, -.371,
2  .273,  .282,  .298,  .309,  .326,  .334,  .342,  .345,  .337,
2  .296,  .210,  .124,  .037, -.049, -.135, -.211, -.231, -.183,
2 -.120, -.058, -.034, -.051, -.068, -.132, -.154, -.148,
3  .479,  .504,  .543,  .563,  .582,  .592,  .603,  .616,  .633,
3  .624,  .576,  .474,  .369,  .264,  .160,  .079,  .067,  .105,
3  .187,  .267,  .272,  .251,  .230,  .107,  .007, -.038,
4  .685,  .727,  .757,  .777,  .796,  .806,  .815,  .824,  .831,
4  .801,  .734,  .664,  .577,  .488,  .400,  .311,  .307,  .368,
4  .435,  .497,  .508,  .481,  .450,  .278,  .142,  .087/
 DATA((CL606(I,J),J=1,26),I=5,7)/
5  .806,  .867,  .913,  .941,  .970,  .984,  .998,  .999,  .975,
5  .921,  .855,  .789,  .723,  .657,  .590,  .533,  .520,  .557,
5  .638,  .711,  .721,  .680,  .639,  .421,  .260,  .188,
6  .936,  .994, 1.036, 1.068, 1.103, 1.122, 1.138, 1.136, 1.100,
6 1.055,  .998,  .941,  .884,  .817,  .746,  .680,  .668,  .714,
6  .793,  .862,  .873,  .835,  .791,  .546,  .366,  .283,
7 1.099, 1.158, 1.208, 1.237, 1.271, 1.288, 1.305, 1.278, 1.238,
7 1.191, 1.135, 1.078, 1.022,  .965,  .907,  .847,  .830,  .880,
7  .952, 1.023, 1.034,  .995,  .949,  .680,  .493,  .403/
 DATA((CL609(I,J),J=1,26),I=1,4)/
1  .077,  .097,  .099,  .100,  .107,  .112,  .113,  .111,  .082,
1 -.022, -.126, -.246, -.369, -.475, -.528, -.522, -.457, -.377,
1 -.299, -.268, -.274, -.284, -.293, -.304, -.309, -.309,
2  .288,  .308,  .334,  .347,  .369,  .379,  .376,  .358,  .304,
2  .227,  .111, -.005, -.123, -.247, -.304, -.308, -.234, -.141,
2 -.081, -.076, -.087, -.097, -.104, -.146, -.167, -.173,
3  .480,  .513,  .542,  .557,  .573,  .581,  .590,  .581,  .546,
3  .482,  .373,  .234,  .081, -.067, -.111, -.095, -.023,  .066,
3  .119,  .111,  .101,  .089,  .078,  .017, -.013, -.044,
4  .675,  .718,  .755,  .776,  .798,  .809,  .788,  .738,  .672,
4  .607,  .542,  .415,  .288,  .163,  .097,  .114,  .200,  .290,
4  .337,  .333,  .319,  .302,  .284,  .191,  .121,  .080/
 DATA((CL609(I,J),J=1,26),I=5,7)/
5  .785,  .830,  .885,  .912,  .950,  .952,  .925,  .857,  .787,
5  .717,  .634,  .533,  .433,  .346,  .307,  .328,  .401,  .490,
5  .535,  .526,  .507,  .487,  .466,  .349,  .256,  .190,
6  .908,  .970, 1.032, 1.074, 1.100, 1.087, 1.026,  .963,  .899,
6  .836,  .755,  .669,  .583,  .505,  .464,  .488,  .576,  .678,
6  .713,  .693,  .671,  .648,  .624,  .483,  .365,  .285,
7 1.019, 1.085, 1.146, 1.183, 1.196, 1.167, 1.121, 1.075, 1.013,
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7  .937,  .861,  .785,  .709,  .641,  .607,  .625,  .705,  .793,
7  .845,  .840,  .819,  .793,  .767,  .619,  .495,  .394/
 DATA((CL612(I,J),J=1,26),I=1,4)/
1  .063,  .079,  .087,  .093,  .099,  .095,  .070, -.002, -.113,
1 -.238, -.363, -.487, -.598, -.607, -.568, -.459, -.325, -.276,
1 -.278, -.280, -.282, -.284, -.286, -.298, -.310, -.321,
2  .247,  .277,  .295,  .305,  .297,  .282,  .247,  .173,  .057,
2 -.071, -.199, -.361, -.450, -.470, -.423, -.307, -.178, -.121,
2 -.123, -.125, -.127, -.129, -.130, -.142, -.153, -.164,
3  .424,  .447,  .466,  .480,  .493,  .487,  .457,  .367,  .245,
3  .122, -.000, -.122, -.241, -.279, -.247, -.118, -.014,  .019,
3  .015,  .011,  .006,  .002, -.002, -.028, -.035, -.032,
4  .601,  .631,  .659,  .676,  .679,  .657,  .590,  .482,  .374,
4  .267,  .159,  .051, -.047, -.077, -.038,  .096,  .187,  .221,
4  .219,  .205,  .192,  .179,  .168,  .118,  .095,  .072/
 DATA((CL612(I,J),J=1,26),I=5,7)/
5  .752,  .790,  .820,  .839,  .840,  .788,  .700,  .604,  .507,
5  .411,  .315,  .218,  .133,  .109,  .145,  .275,  .383,  .407,
5  .393,  .378,  .363,  .348,  .337,  .269,  .225,  .187,
6  .844,  .907,  .969, 1.006, 1.014,  .965,  .869,  .773,  .677,
6  .581,  .485,  .389,  .312,  .291,  .332,  .461,  .554,  .585,
6  .573,  .554,  .534,  .515,  .495,  .410,  .346,  .295,
7  .958, 1.022, 1.083, 1.120, 1.124, 1.072,  .988,  .904,  .820,
7  .717,  .611,  .505,  .428,  .404,  .443,  .561,  .665,  .699,
7  .681,  .663,  .646,  .628,  .611,  .527,  .463,  .416/
 DATA((CL615(I,J),J=1,26),I=1,4)/
1  .072,  .080,  .084,  .086,  .072,  .045, -.003, -.076, -.233,
1 -.407, -.627, -.835, -.922, -.895, -.769, -.591, -.439, -.417,
1 -.413, -.410, -.406, -.403, -.400, -.387, -.372, -.357,
2  .213,  .224,  .226,  .216,  .205,  .200,  .134,  .055, -.086,
2 -.265, -.444, -.616, -.696, -.630, -.506, -.353, -.258, -.250,
2 -.245, -.244, -.243, -.242, -.240, -.227, -.209, -.190,
3  .367,  .378,  .384,  .394,  .377,  .341,  .284,  .207,  .105,
3 -.041, -.232, -.416, -.474, -.415, -.283, -.156, -.114, -.107,
3 -.105, -.103, -.100, -.098, -.096, -.083, -.065, -.046,
4  .544,  .567,  .579,  .586,  .560,  .528,  .449,  .369,  .246,
4  .110, -.057, -.201, -.252, -.207, -.071,  .057,  .094,  .093,
4  .091,  .090,  .088,  .086,  .084,  .071,  .062,  .062/
  DATA((CL615(I,J),J=1,26),I=5,7)/
5  .688,  .717,  .734,  .745,  .725,  .676,  .602,  .515,  .398,
5  .281,  .160,  .046,  .003,  .046,  .182,  .308,  .341,  .335,
5  .328,  .322,  .314,  .306,  .298,  .253,  .212,  .172,
6  .789,  .839,  .870,  .880,  .826,  .777,  .702,  .601,  .500,
6  .375,  .239,  .133,  .087,  .130,  .281,  .404,  .435,  .433,
6  .425,  .418,  .410,  .403,  .395,  .353,  .313,  .274,
7  .887,  .939,  .991, 1.015,  .953,  .889,  .824,  .728,  .607,
7  .487,  .349,  .218,  .172,  .212,  .361,  .490,  .521,  .514,
7  .506,  .499,  .492,  .485,  .478,  .435,  .394,  .355/
 DATA((ALP604(J,N),N=1,9),J=1,13)/
& -7.74, -5.96, -4.19, -2.41,  -.61,  1.29,  3.73,  6.58,  9.07,
& -7.54, -5.86, -4.18, -2.50,  -.82,  1.02,  3.27,  5.80,  8.41,
& -7.26, -5.71, -4.16, -2.61, -1.01,   .75,  2.87,  5.27,  7.81,
& -7.22, -5.70, -4.19, -2.67, -1.12,   .59,  2.66,  4.97,  7.49,
& -7.13, -5.67, -4.22, -2.76, -1.25,   .40,  2.41,  4.60,  7.05,
& -7.10, -5.67, -4.24, -2.80, -1.32,   .31,  2.29,  4.37,  6.82,
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     & -7.05, -5.65, -4.25, -2.84, -1.38,   .21,  2.18,  4.13,  6.59,
     & -7.06, -5.67, -4.28, -2.89, -1.45,   .09,  2.08,  3.91,  6.34,
     & -7.33, -5.88, -4.43, -2.99, -1.52,  -.02,  1.96,  3.72,  6.11,
     & -7.78, -6.23, -4.67, -3.11, -1.58,  -.12,  1.82,  3.63,  6.15,
     & -8.26, -6.59, -4.93, -3.26, -1.65,  -.21,  1.72,  3.72,  6.49,
     & -8.69, -6.90, -5.12, -3.33, -1.62,  -.12,  1.92,  4.04,  7.10,
     & -9.09, -7.10, -5.11, -3.12, -1.29,   .46,  2.60,  4.84,  7.82/
      DATA((ALP604(J,N),N=1,9),J=14,26)/
     & -8.48, -6.50, -4.51, -2.53,  -.74,  1.24,  3.26,  5.71,  8.49,
     & -7.70, -5.77, -3.84, -1.91,  -.04,  2.00,  3.89,  6.49,  9.26,
     & -7.13, -5.14, -3.15, -1.19,   .74,  2.65,  4.67,  7.27, 10.03,
     & -6.58, -4.48, -2.39,  -.46,  1.41,  3.26,  5.42,  8.10, 10.88,
     & -5.67, -3.87, -2.08,  -.14,  1.79,  3.48,  5.70,  8.59, 11.53,
     & -5.71, -3.98, -2.26,  -.34,  1.50,  3.19,  5.26,  7.91, 10.61,
     & -6.43, -4.65, -2.87,  -.92,   .98,  2.69,  4.53,  6.99,  9.42,
     & -7.34, -5.43, -3.51, -1.57,   .43,  2.23,  3.91,  6.29,  8.60,
     & -7.67, -5.75, -3.83, -1.89,   .20,  2.04,  3.74,  5.94,  8.55,
     & -7.74, -5.74, -3.74, -1.71,   .40,  2.20,  4.01,  6.31,  8.78,
     & -6.10, -4.06, -2.02,   .30,  2.54,  5.19,  7.97, 10.69, 13.41,
     & -6.00, -3.08,  -.35,  2.55,  5.74,  8.80, 11.83, 14.86, 17.89,
     & -7.84, -3.19,   .56,  4.15,  7.64, 11.24, 14.85, 18.45, 22.05/
      DATA((ALP606(J,N),N=1,9),J=1,13)/
     & -8.23, -6.38, -4.53, -2.68,  -.77,  1.17,  3.90,  6.79,  9.24,
     & -8.01, -6.25, -4.48, -2.72,  -.94,   .86,  3.04,  6.07,  8.51,
     & -7.87, -6.18, -4.50, -2.82, -1.17,   .53,  2.55,  5.41,  7.91,
     & -7.81, -6.17, -4.53, -2.89, -1.28,   .35,  2.28,  4.93,  7.56,
     & -7.67, -6.11, -4.55, -2.98, -1.42,   .17,  2.05,  4.45,  7.15,
     & -7.60, -6.08, -4.55, -3.02, -1.49,   .07,  1.94,  4.23,  6.94,
     & -7.52, -6.03, -4.54, -3.06, -1.56,  -.02,  1.86,  4.03,  6.74,
     & -7.44, -5.98, -4.52, -3.06, -1.59,  -.12,  1.77,  4.01,  6.90,
     & -7.03, -5.67, -4.30, -2.94, -1.57,  -.22,  1.69,  4.40,  7.45,
     & -6.24, -5.02, -3.80, -2.59, -1.37,  -.15,  1.99,  5.18,  8.13,
     & -5.77, -4.53, -3.30, -2.06,  -.96,   .30,  3.09,  6.03,  8.95,
     & -5.26, -4.02, -2.77, -1.57,  -.42,  1.33,  4.14,  6.86,  9.78,
     & -4.77, -3.50, -2.23, -1.02,   .30,  2.32,  4.96,  7.68, 10.58/
      DATA((ALP606(J,N),N=1,9),J=14,26)/
     & -4.24, -2.96, -1.69,  -.41,  1.21,  3.33,  5.79,  8.47, 11.18,
     & -3.72, -2.42, -1.08,   .33,  2.00,  4.13,  6.67,  9.16, 11.64,
     & -3.26, -1.92,  -.54,  1.04,  2.80,  4.91,  7.44,  9.83, 12.23,
     & -3.19, -1.79,  -.45,  1.11,  2.87,  5.08,  7.63, 10.10, 12.57,
     & -3.44, -2.11,  -.73,   .72,  2.34,  4.55,  7.04,  9.45, 11.86,
     & -3.87, -2.53, -1.22,   .10,  1.72,  3.63,  6.09,  8.60, 11.12,
     & -4.29, -2.95, -1.64,  -.41,  1.16,  2.96,  5.18,  7.71, 10.20,
     & -4.42, -3.10, -1.78,  -.47,  1.08,  2.86,  5.04,  7.58, 10.06,
     & -4.37, -3.01, -1.66,  -.34,  1.30,  3.20,  5.55,  8.06, 10.56,
     & -4.34, -2.93, -1.54,  -.20,  1.55,  3.59,  6.11,  8.65, 11.18,
     & -4.34, -2.59,  -.90,  1.09,  3.71,  6.81,  9.79, 12.78, 15.76,
     & -4.32, -2.43,  -.09,  2.98,  6.54,  9.69, 12.83, 15.98, 19.13,
     & -4.26, -2.47,   .61,  4.25,  7.95, 11.28, 14.62, 17.95, 21.28/
      DATA((ALP609(J,N),N=1,9),J=1,13)/
     & -8.52, -6.63, -4.73, -2.83,  -.83,  1.23,  4.24,  7.66, 11.26,
     & -8.71, -6.82, -4.92, -3.02, -1.10,   .85,  3.46,  6.52, 10.00,
     & -8.25, -6.54, -4.84, -3.14, -1.37,   .54,  2.69,  5.56,  8.95,
     & -8.05, -6.43, -4.81, -3.19, -1.50,   .39,  2.35,  5.09,  8.31,
     & -7.87, -6.34, -4.82, -3.29, -1.70,   .24,  2.03,  4.67,  8.08,
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     & -7.84, -6.34, -4.84, -3.34, -1.79,   .17,  1.92,  4.71,  8.83,
     & -7.90, -6.38, -4.86, -3.34, -1.78,   .10,  2.18,  5.49,  9.66,
     & -8.14, -6.52, -4.90, -3.28, -1.62,   .24,  3.04,  6.66, 10.23,
     & -8.34, -6.54, -4.74, -2.94, -1.21,   .86,  4.23,  7.77, 11.28,
     & -7.04, -5.43, -3.82, -2.22,  -.64,  1.89,  5.39,  9.25, 13.21,
     & -6.31, -4.62, -2.94, -1.32,   .32,  3.26,  6.85, 10.62, 14.40,
     & -5.28, -3.62, -1.96,  -.28,  1.83,  4.99,  8.26, 11.71, 15.16,
     & -4.25, -2.63,  -.79,  1.15,  3.54,  6.27,  9.44, 12.62, 15.79/
      DATA((ALP609(J,N),N=1,9),J=14,26)/
     & -3.34, -1.48,   .58,  2.40,  4.68,  7.40, 10.34, 13.28, 16.22,
     & -2.86,  -.92,  1.07,  2.98,  5.18,  7.90, 10.70, 13.50, 16.29,
     & -2.86,  -.99,   .91,  2.80,  4.90,  7.64, 10.55, 13.47, 16.39,
     & -3.49, -1.68,   .21,  2.00,  3.99,  6.37,  9.47, 12.57, 15.67,
     & -4.19, -2.50,  -.64,  1.20,  3.10,  5.17,  8.12, 11.60, 15.08,
     & -4.93, -3.09, -1.19,   .74,  2.64,  4.73,  7.32, 10.35, 13.38,
     & -5.38, -3.29, -1.19,   .80,  2.69,  4.89,  7.46, 10.18, 12.90,
     & -5.35, -3.21, -1.07,   .91,  2.86,  5.13,  7.74, 10.45, 13.15,
     & -5.24, -3.10,  -.96,  1.04,  3.06,  5.40,  8.10, 10.86, 13.61,
     & -5.13, -3.02,  -.86,  1.18,  3.27,  5.70,  8.46, 11.26, 14.06,
     & -5.22, -2.68,  -.21,  2.11,  4.76,  7.72, 10.66, 13.60, 16.54,
     & -5.28, -2.46,   .19,  3.17,  6.54,  9.62, 12.69, 15.77, 18.85,
     & -5.34, -2.40,   .71,  4.21,  8.11, 11.78, 15.45, 19.12, 22.79/
      DATA((ALP612(J,N),N=1,9),J=1,13)/
     & -9.03, -6.86, -4.68, -2.51,  -.27,  1.99,  5.04,  8.74, 12.25,
     & -8.84, -6.82, -4.80, -2.78,  -.55,  1.66,  4.17,  7.62, 11.10,
     & -8.68, -6.76, -4.84, -2.91,  -.77,  1.39,  3.75,  6.54, 10.05,
     & -8.65, -6.76, -4.88, -2.99,  -.91,  1.22,  3.52,  5.93,  9.40,
     & -9.04, -7.02, -5.00, -2.98,  -.95,  1.15,  3.50,  5.84,  9.38,
     & -9.29, -7.16, -5.02, -2.88,  -.85,  1.33,  4.14,  6.65, 10.39,
     & -9.31, -7.05, -4.79, -2.53,  -.54,  2.18,  5.18,  8.20, 11.56,
     & -8.55, -6.26, -3.98, -1.72,   .57,  3.93,  6.41,  9.47, 12.52,
     & -7.38, -5.02, -2.67,  -.48,  2.39,  5.09,  7.72, 10.52, 13.31,
     & -5.94, -3.54, -1.26,  1.08,  3.85,  6.28,  9.22, 12.16, 15.10,
     & -4.45, -2.01,  0.00,  2.53,  5.00,  7.83, 11.00, 14.17, 17.35,
     & -2.62,  -.65,  1.41,  3.78,  6.19,  9.64, 13.09, 16.53, 19.98,
     & -1.52,   .42,  2.52,  4.75,  7.52, 10.97, 14.41, 17.86, 21.31/
      DATA((ALP612(J,N),N=1,9),J=14,26)/
     & -1.27,   .78,  2.83,  5.00,  7.93, 11.47, 15.01, 18.55, 22.09,
     & -1.74,   .45,  2.42,  4.59,  7.23, 10.83, 14.43, 18.04, 21.64,
     & -3.22,  -.87,  1.10,  3.16,  5.34,  8.78, 12.78, 16.78, 20.78,
     & -5.02, -2.30,   .14,  2.13,  4.20,  6.83, 10.43, 14.04, 17.64,
     & -5.60, -3.02,  -.27,  1.79,  3.92,  6.26,  9.77, 13.28, 16.79,
     & -5.57, -2.99,  -.22,  1.81,  4.08,  6.50, 10.20, 13.91, 17.61,
     & -5.55, -2.97,  -.16,  1.95,  4.25,  6.84, 10.51, 14.18, 17.85,
     & -5.52, -2.94,  -.09,  2.09,  4.43,  7.18, 10.75, 14.32, 17.89,
     & -5.50, -2.92,  -.03,  2.25,  4.62,  7.50, 11.04, 14.58, 18.12,
     & -5.46, -2.90,   .02,  2.38,  4.80,  7.81, 11.26, 14.71, 18.16,
     & -5.31, -2.74,   .38,  3.09,  5.86,  9.25, 12.67, 16.09, 19.50,
     & -5.15, -2.60,   .54,  3.62,  6.92, 10.34, 13.76, 17.18, 20.60,
     & -5.01, -2.46,   .62,  4.24,  7.74, 11.04, 14.35, 17.65, 20.96/
      DATA((ALP615(J,N),N=1,9),J=1,13)/
     &-10.70, -7.86, -5.02, -2.18,   .37,  2.78,  6.22, 10.31, 14.39,
     &-10.67, -7.89, -5.11, -2.33,   .23,  2.44,  5.36,  9.22, 13.22,
     &-10.82, -8.00, -5.18, -2.37,   .16,  2.27,  4.97,  8.15, 11.45,
     &-11.48, -8.40, -5.32, -2.25,   .06,  2.18,  4.81,  7.78, 10.74,
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&-11.10, -8.09, -5.08, -2.08,   .25,  2.48,  5.49,  8.74, 11.89,
& -9.74, -7.16, -4.58, -2.00,   .63,  2.97,  6.41,  9.98, 13.55,
& -9.80, -6.88, -3.96, -1.12,  1.41,  3.97,  7.61, 10.89, 14.16,
& -8.95, -5.89, -2.84,  -.09,  2.42,  5.98,  9.13, 12.28, 15.43,
& -6.27, -3.55, -1.10,  1.35,  4.04,  7.87, 11.61, 15.35, 19.08,
& -3.90, -1.42,   .54,  3.05,  6.45, 10.02, 13.59, 17.16, 20.73,
& -1.58,   .37,  2.53,  5.01,  8.93, 12.56, 16.20, 19.84, 23.47,
&   .15,  2.01,  3.63,  7.58, 12.28, 16.99, 21.69, 26.40, 31.11,
&   .67,  2.41,  3.98,  8.66, 13.36, 18.07, 22.78, 27.48, 32.19/
 DATA((ALP615(J,N),N=1,9),J=14,26)/
&   .14,  2.06,  3.64,  7.71, 12.59, 17.46, 22.34, 27.22, 32.10,
& -1.05,   .78,  2.56,  4.36,  8.98, 13.98, 18.98, 23.98, 28.98,
& -2.39,  -.45,  1.46,  3.14,  5.92, 10.56, 15.21, 19.86, 24.51,
& -3.57, -1.19,  1.10,  2.86,  5.26,  9.84, 14.49, 19.14, 23.79,
& -3.80, -1.30,  1.07,  2.88,  5.33, 10.12, 15.06, 20.00, 24.94,
& -3.85, -1.36,  1.07,  2.92,  5.48, 10.32, 15.26, 20.20, 25.14,
& -3.88, -1.38,  1.07,  2.95,  5.63, 10.49, 15.43, 20.37, 25.31,
& -3.93, -1.40,  1.06,  2.99,  5.79, 10.63, 15.51, 20.39, 25.27,
& -3.96, -1.42,  1.07,  3.04,  5.94, 10.80, 15.68, 20.56, 25.44,
& -4.00, -1.44,  1.07,  3.08,  6.12, 10.94, 15.76, 20.58, 25.40,
& -4.16, -1.63,  1.08,  3.42,  7.15, 12.02, 16.90, 21.78, 26.66,
& -4.34, -1.88,  1.02,  3.84,  8.15, 13.09, 18.02, 22.96, 27.90,
& -4.51, -2.12,   .85,  4.55,  9.11, 14.05, 18.99, 23.93, 28.86/
 DATA((CD604(I,J),J=1,26),I=1,5)/
1 .0224, .0253, .0268, .0275, .0282, .0286, .0289, .0293, .0297,
1 .0301, .0318, .0354, .0408, .0462, .0515, .0569, .0616, .0655,
1 .0675, .0687, .0694, .0700, .0705, .0628, .0458, .0344,
2 .0120, .0134, .0141, .0144, .0148, .0150, .0151, .0153, .0157,
2 .0162, .0185, .0220, .0274, .0328, .0382, .0435, .0487, .0518,
2 .0546, .0561, .0566, .0572, .0578, .0560, .0491, .0397,
3 .0063, .0062, .0062, .0062, .0062, .0062, .0062, .0063, .0065,
3 .0073, .0117, .0162, .0206, .0250, .0299, .0359, .0419, .0480,
3 .0523, .0543, .0564, .0584, .0595, .0646, .0691, .0731,
4 .0055, .0054, .0053, .0053, .0053, .0053, .0053, .0053, .0056,
4 .0064, .0098, .0134, .0169, .0227, .0310, .0393, .0478, .0550,
4 .0600, .0650, .0698, .0737, .0776, .0987, .1129, .1284,
5 .0070, .0067, .0065, .0066, .0066, .0066, .0066, .0068, .0070,
5 .0083, .0153, .0223, .0293, .0370, .0498, .0621, .0724, .0826,
5 .0921, .1016, .1094, .1163, .1232, .1587, .1786, .1906/
 DATA((CD606(I,J),J=1,26),I=1,5)/
1 .0198, .0213, .0221, .0225, .0228, .0230, .0232, .0236, .0248,
1 .0264, .0296, .0334, .0382, .0441, .0500, .0559, .0617, .0667,
1 .0694, .0717, .0723, .0729, .0735, .0662, .0532, .0411,
2 .0116, .0116, .0115, .0115, .0115, .0117, .0121, .0129, .0140,
2 .0160, .0186, .0227, .0274, .0322, .0372, .0429, .0485, .0534,
2 .0569, .0605, .0640, .0676, .0688, .0672, .0579, .0484,
3 .0058, .0058, .0058, .0058, .0058, .0061, .0065, .0074, .0088,
3 .0121, .0153, .0186, .0219, .0271, .0353, .0435, .0517, .0574,
3 .0631, .0682, .0711, .0740, .0770, .0803, .0810, .0810,
4 .0058, .0059, .0059, .0059, .0059, .0059, .0059, .0064, .0075,
4 .0089, .0124, .0169, .0213, .0265, .0374, .0481, .0586, .0673,
4 .0737, .0796, .0843, .0889, .0936, .1144, .1293, .1430,
5 .0082, .0075, .0072, .0072, .0073, .0076, .0080, .0088, .0102,
5 .0144, .0245, .0346, .0448, .0549, .0651, .0858, .1041, .1178,
5 .1304, .1417, .1530, .1630, .1721, .2178, .2484, .2682/
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 DATA((CD609(I,J),J=1,26),I=1,5)/
1 .0179, .0177, .0176, .0176, .0175, .0175, .0175, .0182, .0201,
1 .0235, .0291, .0347, .0439, .0536, .0629, .0710, .0786, .0846,
1 .0905, .0965, .1016, .1035, .1053, .1071, .0972, .0780,
2 .0113, .0112, .0111, .0111, .0115, .0120, .0127, .0139, .0162,
2 .0206, .0249, .0293, .0343, .0418, .0493, .0568, .0640, .0707,
2 .0771, .0811, .0844, .0863, .0882, .0854, .0757, .0655,
3 .0066, .0064, .0062, .0062, .0064, .0068, .0076, .0096, .0121,
3 .0147, .0189, .0254, .0320, .0409, .0525, .0640, .0716, .0787,
3 .0858, .0910, .0942, .0974, .1002, .1024, .1015, .0989,
4 .0079, .0078, .0078, .0078, .0077, .0078, .0081, .0087, .0099,
4 .0147, .0200, .0264, .0351, .0454, .0575, .0699, .0816, .0907,
4 .0992, .1058, .1123, .1179, .1207, .1356, .1464, .1536,
5 .0100, .0081, .0073, .0073, .0080, .0087, .0103, .0126, .0165,
5 .0204, .0279, .0371, .0463, .0619, .0779, .0975, .1169, .1352,
5 .1478, .1572, .1642, .1672, .1691, .1762, .1809, .1855/
 DATA((CD612(I,J),J=1,26),I=1,5)/
1 .0197, .0206, .0211, .0217, .0223, .0227, .0232, .0259, .0312,
1 .0381, .0462, .0550, .0638, .0725, .0818, .0930, .1020, .1104,
1 .1189, .1256, .1302, .1348, .1366, .1294, .1084, .0833,
2 .0127, .0127, .0128, .0128, .0133, .0138, .0163, .0209, .0270,
2 .0349, .0430, .0519, .0617, .0712, .0806, .0894, .0976, .1058,
2 .1140, .1199, .1257, .1316, .1363, .1379, .1187, .0947,
3 .0097, .0097, .0096, .0096, .0103, .0115, .0139, .0178, .0235,
3 .0313, .0407, .0512, .0621, .0725, .0830, .0942, .1054, .1136,
3 .1218, .1300, .1365, .1426, .1486, .1538, .1444, .1284,
4 .0078, .0078, .0078, .0078, .0078, .0091, .0111, .0141, .0208,
4 .0275, .0343, .0454, .0578, .0707, .0839, .0971, .1100, .1230,
4 .1343, .1432, .1521, .1610, .1678, .1968, .1952, .1853,
5 .0107, .0107, .0107, .0107, .0108, .0123, .0166, .0219, .0313,
5 .0471, .0636, .0798, .0959, .1103, .1236, .1374, .1517, .1661,
5 .1785, .1897, .2008, .2120, .2229, .2798, .3189, .3488/
 DATA((CD615(I,J),J=1,26),I=1,5)/
1 .0160, .0272, .0328, .0355, .0386, .0413, .0450, .0534, .0628,
1 .0731, .0834, .0924, .1011, .1097, .1182, .1256, .1324, .1392,
1 .1453, .1504, .1553, .1572, .1591, .1547, .1349, .1190,
2 .0131, .0130, .0130, .0137, .0155, .0186, .0248, .0326, .0454,
2 .0598, .0752, .0895, .1014, .1132, .1237, .1317, .1396, .1454,
2 .1510, .1559, .1586, .1612, .1631, .1594, .1409, .1243,
3 .0106, .0105, .0105, .0106, .0120, .0146, .0225, .0319, .0413,
3 .0579, .0740, .0899, .1063, .1201, .1294, .1387, .1469, .1546,
3 .1623, .1689, .1722, .1755, .1788, .1755, .1678, .1583,
4 .0099, .0098, .0098, .0098, .0108, .0132, .0200, .0302, .0404,
4 .0506, .0663, .0833, .1017, .1200, .1346, .1490, .1625, .1722,
4 .1818, .1908, .1951, .1993, .2036, .2162, .2173, .2155,
5 .0119, .0119, .0119, .0125, .0147, .0215, .0314, .0413, .0610,
5 .0817, .1049, .1285, .1509, .1732, .1923, .2092, .2262, .2423,
5 .2559, .2695, .2796, .2788, .2780, .2734, .2688, .2642/
 DATA(XMI(J),J=1,26)/.3,.5,.6,.65,.7,.725,.75,.775,
& .8,.825,.85,.875,.9,.925,.95,.975,1.0,1.025,1.05,1.075,
&1.1,1.125,1.15,1.3,1.45,1.6/
 DATA(CLI(J),J=1,9)/-.4,-.2,0.0,.2,.4,.6,.8,1.0,1.2/
 DATA(ALPI(J),J=1,7)/-4.0,-2.0,0.0,2.0,4.0,6.0,8.0/
 DATA(CLII(J),J=1,5)/0.0,.2,.4,.6,.8/
 IORDER(1)=IORDER(2)=1
```

```
      IPT (1) = -1
      IF (IKEY .EQ. 2) GO TO 1000
      IF (TR .LT. .04) GO TO 9
      IF (TR .GE. .04 .AND. TR .LT. .06) GO TO 1
      IF (TR .GE. .06 .AND. TR .LT. .09) GO TO 2
      IF (TR .GE. .09 .AND. TR .LT. .12) GO TO 3
      IF (TR .GE. .12 .AND. TR .LT. .15) GO TO 4
      IF (TR .GE. .15) GO TO 5
    9 CALL IBI (7,ALPI,26,XMI,7,CL604,IORDER,IPT,AA,XM,CLFT04,IERR)
      CL=CLFT04
      GO TO 400
    1 CALL IBI (7,ALPI,26,XMI,7,CL604,IORDER,IPT,AA,XM,CLFT04,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL606,IORDER,IPT,AA,XM,CLFT06,IERR)
      CL=CLFT04 + (CLFT06-CLFT04)*((TR-.04)/(.06-.04))
      GO TO 400
    2 CALL IBI (7,ALPI,26,XMI,7,CL606,IORDER,IPT,AA,XM,CLFT06,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL609,IORDER,IPT,AA,XM,CLFT09,IERR)
      CL=CLFT06 + (CLFT09 - CLFT06)*((TR-.06)/(.09-.06))
      GO TO 400
    3 CALL IBI (7,ALPI,26,XMI,7,CL609,IORDER,IPT,AA,XM,CLFT09,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL612,IORDER,IPT,AA,XM,CLFT12,IERR)
      CL=CLFT09+(CLFT12-CLFT09)*((TR-.09)/(.12-.09))
      GO TO 400
    4 CALL IBI (7,ALPI,26,XMI,7,CL612,IORDER,IPT,AA,XM,CLFT12,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL615,IORDER,IPT,AA,XM,CLFT15,IERR)
      CL=CLFT12 + (CLFT15-CLFT12)*((TR-.12)/(.15-.12))
      GO TO 400
    5 CALL IBI (7,ALPI,26,XMI,7,CL615,IORDER,IPT,AA,XM,CLFT15,IERR)
      CL=CLFT15
      GO TO 400
 1000 CONTINUE
      IPT (1)=-1
      IF (TR .LT. .04) GO TO 90
      IF (TR .GE. .04 .AND. TR .LT. .06) GO TO 10
      IF (TR .GE. .06 .AND. TR .LT. .09) GO TO 20
      IF (TR .GE. .09 .AND. TR .LT. .12) GO TO 30
      IF (TR .GE. .12 .AND. TR .LT. .15) GO TO 40
      IF (TR .GE. .15) GO TO 50
   90 CALL IBI (26,XMI,9,CLI,26,ALP604,IORDER,IPT,XM,CL,AA04,IERR)
      AA=AA04
      GO TO 400
   10 CALL IBI (26,XMI,9,CLI,26,ALP604,IORDER,IPT,XM,CL,AA04,IERR)
      IPT (1) = -1
      CALL IBI (26,XMI,9,CLI,26,ALP606,IORDER,IPT,XM,CL,AA06,IERR)
      AA=AA04 + (AA06-AA04)*((TR-.04)/(.06-.04))
      GO TO 400
   20 CALL IBI (26,XMI,9,CLI,26,ALP606,IORDER,IPT,XM,CL,AA06,IERR)
      IPT (1) = -1
      CALL IBI (26,XMI,9,CLI,26,ALP609,IORDER,IPT,XM,CL,AA09,IERR)
      AA=AA06 + (AA09 - AA06)*((TR -.06)/(.09-.06))
      GO TO 400
```

```
   30  CALL IBI (26,XMI,9,CLI,26,ALP609,IORDER,IPT,XM,CL,AA09,IERR)
       IPT (1) = -1
       CALL IBI (26,XMI,9,CLI,26,ALP612,IORDER,IPT,XM,CL,AA12,IERR)
       AA=AA09+(AA12-AA09)*((TR-.09)/(.12-.09))
       GO TO 400
   40  CALL IBI (26,XMI,9,CLI,26,ALP612,IORDER,IPT,XM,CL,AA12,IERR)
       IPT (1) = -1
       CALL IBI (26,XMI,9,CLI,26,ALP615,IORDER,IPT,XM,CL,AA15,IERR)
       AA=AA12+(AA15-AA12)*((TR-.12)/(.15-.12))
       GO TO 400
   50  CALL IBI (26,XMI,9,CLI,26,ALP615,IORDER,IPT,XM,CL,AA15,IERR)
       AA=AA15
  400  CONTINUE
       IPT (1)=-1
       IF (TR .LT. .04) GO TO 91
       IF (TR .GE. .04 .AND. TR .LT. .06) GO TO 11
       IF (TR .GE. .06 .AND. TR .LT. .09) GO TO 21
       IF (TR .GE. .09 .AND. TR .LT. .12) GO TO 31
       IF (TR .GE. .12 .AND. TR .LT. .15) GO TO 41
       IF (TR .GE. .15) GO TO 51
    91 CALL IBI (5,CLII,26,XMI,5,CD604,IORDER,IPT,CL,XM,CDRG04,IERR)
       CD=CDRG04
       WRITE (6,201) TR
  201  FORMAT(*0THICKNESS RATIO=*,F5.3,* IS OUT OF RANGE.
      &*/* THE VALUES FOR T/C=.04 HAVE BEEN RETURNED*)
       GO TO 250
    11 CALL IBI (5,CLII,26,XMI,5,CD604,IORDER,IPT,CL,XM,CDRG04,IERR)
       IPT (1)=-1
       CALL IBI (5,CLII,26,XMI,5,CD606,IORDER,IPT,CL,XM,CDRG06,IERR)
       CD=CDRG04 + (CDRG06-CDRG04)*((TR-.04)/(.06-.04))
       GO TO 250
    21 CALL IBI (5,CLII,26,XMI,5,CD606,IORDER,IPT,CL,XM,CDRG06,IERR)
       IPT (1)=-1
       CALL IBI (5,CLII,26,XMI,5,CD609,IORDER,IPT,CL,XM,CDRG09,IERR)
       CD=CDRG06 + (CDRG09 - CDRG06)*((TR-.06)/(.09-.06))
       GO TO 250
    31 CALL IBI (5,CLII,26,XMI,5,CD609,IORDER,IPT,CL,XM,CDRG09,IERR)
       IPT (1)=-1
       CALL IBI (5,CLII,26,XMI,5,CD612,IORDER,IPT,CL,XM,CDRG12,IERR)
       CD=CDRG09+(CDRG12-CDRG09)*((TR-.09)/(.12-.09))
       GO TO 250
    41 CALL IBI (5,CLII,26,XMI,5,CD612,IORDER,IPT,CL,XM,CDRG12,IERR)
       IPT (1)=-1
       CALL IBI (5,CLII,26,XMI,5,CD615,IORDER,IPT,CL,XM,CDRG15,IERR)
       CD=CDRG12 + (CDRG15-CDRG12)*((TR-.12)/(.15-.12))
       GO TO 250
    51 CALL IBI (5,CLII,26,XMI,5,CD615,IORDER,IPT,CL,XM,CDRG15,IERR)
       CD=CDRG15
       IF (TR .GT. .15) WRITE (6,205) TR
  205  FORMAT(*0THICKNESS RATIO=*,F5.3,* IS OUT OF RANGE.
      &*/* THE VALUES  FOR T/C=.15 HAVE BEEN RETURNED.*)
  250  IF(CL .GT. .8) GO TO 251
       RETURN
  251  CALL COMPUT(D,XM,ALT,COR,TR,AA,CDT,CL,CD,CLDES)
       CD=CDT
```

```
      RETURN
      END


      SUBROUTINE AERO7(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
C
C
C THIS SUBROUTINE IS DESIGNED TO COMPUTE THE AIRFOIL
C CHARACTERISTICS FOR A 16 SERIES AIRFOIL WITH A GIVEN CAMBER.
C
C THIS SUBROUTINE RELATES CL,CD,CL/CD,MACH,T/C,AND ALPHA.
C IT REPRESENTS THE DATA OF A 16-7XX AIRFOIL.
C
C XM=RELATIVE MACH NO. AT BLADE ELEMENT
C AA=ANGLE OF ATTACK IN DEGREES
C IKEY1: CL=CL(MACH,ALPHA,T/C)
C      : CD=CD(MACH,CL,T/C)
C      :XLD=CL/CD
C IKEY2: ALPHA=ALPHA(MACH,CL,T/C)
C      : CD=CD(MACH,CL,T/C)
C      :XLD=CL/CD
C TR=T/C
C
C
C
C
      DIMENSION IORDER(2),IPT(2),ALP706(26,9),
     & ALP709(26,9),ALP712(26,9),
     & CLI(9),XMI(26),ALPI(7),
     & CL706(7,26),CL709(7,26),CL712(7,26),
     & CD709(5,26),CD712(5,26),CD706(5,26),CLII(5)
      DATA((CL706(I,J),J=1,26),I=1,4)/
     1  .112,  .118,  .128,  .133,  .140,  .146,  .153,  .157,  .148,
     1  .117,  .075,  .010, -.071, -.158, -.245, -.325, -.349, -.309,
     1 -.188, -.101, -.081, -.098, -.114, -.202, -.259, -.280,
     2  .340,  .359,  .381,  .398,  .416,  .424,  .441,  .443,  .417,
     2  .379,  .333,  .267,  .190,  .094, -.013, -.129, -.151, -.115,
     2 -.021,  .066,  .083,  .068,  .050, -.050, -.136, -.159,
     3  .519,  .569,  .599,  .618,  .649,  .672,  .695,  .705,  .675,
     3  .618,  .537,  .435,  .330,  .224,  .118,  .027,  .015,  .076,
     3  .153,  .225,  .248,  .225,  .202,  .074, -.021, -.038,
     4  .715,  .768,  .802,  .823,  .843,  .856,  .874,  .866,  .825,
     4  .761,  .679,  .592,  .505,  .418,  .331,  .246,  .246,  .299,
     4  .381,  .455,  .457,  .431,  .402,  .231,  .106,  .076/
      DATA((CL706(I,J),J=1,26),I=5,7)/
     5  .852,  .911,  .947,  .973, 1.002, 1.017, 1.027, 1.013,  .963,
     5  .891,  .813,  .734,  .655,  .577,  .498,  .445,  .439,  .498,
     5  .583,  .655,  .661,  .628,  .594,  .400,  .255,  .186,
     6  .983, 1.043, 1.092, 1.126, 1.163, 1.182, 1.183, 1.168, 1.126,
     6 1.057,  .980,  .904,  .827,  .751,  .674,  .615,  .621,  .689,
     6  .768,  .837,  .839,  .807,  .767,  .539,  .372,  .297,
     7 1.135, 1.201, 1.252, 1.282, 1.329, 1.345, 1.339, 1.315, 1.268,
     7 1.205, 1.138, 1.071, 1.005,  .938,  .872,  .818,  .818,  .884,
     7  .975, 1.040, 1.036,  .991,  .943,  .676,  .491,  .403/
```

```
 DATA((CL709(I,J),J=1,26),I=1,4)/
1  .158,  .164,  .168,  .170,  .174,  .163,  .140,  .080,  .011,
1 -.085, -.264, -.442, -.620, -.779, -.849, -.801, -.717, -.609,
1 -.500, -.392, -.321, -.312, -.319, -.352, -.369, -.387,
2  .359,  .388,  .407,  .420,  .433,  .420,  .402,  .348,  .285,
2  .180,  .041, -.125, -.291, -.448, -.527, -.475, -.375, -.266,
2 -.158, -.115, -.120, -.125, -.132, -.181, -.210, -.210,
3  .550,  .594,  .624,  .644,  .664,  .673,  .640,  .605,  .519,
3  .429,  .295,  .153,  .011, -.122, -.191, -.175, -.077,  .043,
3  .102,  .097,  .086,  .076,  .066,  .017, -.012, -.029,
4  .734,  .783,  .814,  .837,  .856,  .844,  .821,  .771,  .710,
4  .648,  .527,  .388,  .248,  .130,  .088,  .095,  .178,  .263,
4  .322,  .313,  .294,  .277,  .263,  .179,  .119,  .076/
 DATA((CL709(I,J),J=1,26),I=5,7)/
5  .852,  .906,  .958,  .984, 1.016,  .997,  .970,  .902,  .828,
5  .754,  .680,  .597,  .467,  .337,  .243,  .256,  .334,  .467,
5  .512,  .506,  .489,  .471,  .452,  .336,  .253,  .194,
6  .961, 1.023, 1.097, 1.137, 1.127, 1.107, 1.057, 1.007,  .957,
6  .879,  .798,  .717,  .620,  .500,  .435,  .444,  .529,  .642,
6  .711,  .702,  .678,  .654,  .630,  .502,  .391,  .297,
7 1.096, 1.173, 1.231, 1.264, 1.239, 1.193, 1.147, 1.101, 1.055,
7  .979,  .897,  .816,  .734,  .644,  .586,  .598,  .689,  .843,
7  .872,  .849,  .827,  .803,  .779,  .634,  .514,  .414/
 DATA((CL712(I,J),J=1,26),I=1,4)/
1  .122,  .144,  .154,  .164,  .141,  .103,  .051, -.044, -.167,
1 -.290, -.418, -.558, -.612, -.625, -.593, -.522, -.413, -.338,
1 -.322, -.324, -.326, -.328, -.331, -.343, -.351, -.357,
2  .320,  .352,  .368,  .380,  .364,  .332,  .264,  .146,  .016,
2 -.115, -.245, -.381, -.459, -.478, -.440, -.339, -.224, -.162,
2 -.159, -.162, -.166, -.170, -.175, -.195, -.193, -.195,
3  .495,  .538,  .559,  .575,  .568,  .529,  .442,  .324,  .191,
3  .054, -.083, -.219, -.318, -.351, -.309, -.167, -.031,  .001,
3  .003, -.003, -.009, -.015, -.021, -.041, -.044, -.050,
4  .684,  .720,  .748,  .758,  .731,  .671,  .573,  .451,  .329,
4  .207,  .084, -.038, -.119, -.145, -.101,  .043,  .164,  .195,
4  .187,  .179,  .171,  .162,  .154,  .110,  .080,  .059/
 DATA((CL712(I,J),J=1,26),I=5,7)/
5  .819,  .875,  .903,  .920,  .873,  .773,  .673,  .572,  .472,
5  .372,  .272,  .172,  .091,  .064,  .115,  .255,  .373,  .400,
5  .394,  .383,  .370,  .357,  .344,  .271,  .216,  .171,
6  .936, 1.006, 1.058, 1.079, 1.019,  .950,  .850,  .751,  .652,
6  .552,  .453,  .354,  .281,  .253,  .310,  .457,  .583,  .594,
6  .577,  .560,  .544,  .527,  .511,  .417,  .348,  .283,
7 1.032, 1.099, 1.153, 1.182, 1.125, 1.061,  .984,  .886,  .788,
7  .691,  .593,  .495,  .402,  .377,  .419,  .603,  .727,  .737,
7  .724,  .707,  .689,  .672,  .654,  .548,  .468,  .395/
 DATA((ALP706(J,N),N=1,9),J=1,13)/
& -8.49, -6.74, -4.98, -3.23, -1.33,   .83,  3.24,  6.22,  8.86,
& -8.30, -6.64, -4.98, -3.32, -1.61,   .31,  2.45,  5.35,  7.99,
& -8.17, -6.59, -5.01, -3.43, -1.83,   .01,  1.98,  4.73,  7.35,
& -8.02, -6.51, -5.00, -3.49, -1.98,  -.16,  1.78,  4.35,  6.95,
& -7.91, -6.46, -5.01, -3.57, -2.12,  -.42,  1.56,  3.97,  6.45,
& -7.93, -6.49, -5.05, -3.61, -2.17,  -.58,  1.39,  3.79,  6.22,
& -7.84, -6.45, -5.06, -3.67, -2.28,  -.75,  1.17,  3.65,  6.22,
& -7.90, -6.50, -5.10, -3.70, -2.30,  -.80,  1.18,  3.82,  6.44,
```

```
     & -8.07, -6.59, -5.10, -3.61, -2.13,  -.58,  1.67,  4.45,  7.04,
     & -7.95, -6.42, -4.89, -3.37, -1.82,  -.15,  2.60,  5.31,  7.93,
     & -7.68, -6.13, -4.58, -3.03, -1.34,   .89,  3.81,  6.25,  8.78,
     & -7.19, -5.63, -4.08, -2.52,  -.42,  2.11,  4.78,  7.15,  9.54,
     & -6.52, -4.99, -3.46, -1.86,   .80,  3.27,  5.69,  7.94, 10.19/
      DATA((ALP706(J,N),N=1,9),J=14,26)/
     & -5.92, -4.33, -2.75,  -.37,  1.81,  4.26,  6.52,  8.66, 10.80,
     & -5.34, -3.61, -1.80,   .77,  2.83,  5.16,  7.27,  9.29, 11.31,
     & -4.77, -2.72,  -.35,  1.58,  3.55,  5.82,  7.82,  9.79, 11.76,
     & -4.52, -2.49,  -.18,  1.60,  3.60,  5.77,  7.82,  9.85, 11.88,
     & -4.94, -2.88,  -.80,  1.11,  3.02,  5.07,  7.14,  9.19, 11.24,
     & -6.54, -4.14, -1.76,   .41,  2.19,  4.18,  6.31,  8.24, 10.17,
     & -7.58, -5.19, -2.79,  -.31,  1.52,  3.45,  5.59,  7.61,  9.58,
     & -7.89, -5.45, -3.01,  -.58,  1.45,  3.40,  5.56,  7.63,  9.66,
     & -7.64, -5.23, -2.82,  -.32,  1.70,  3.72,  5.92,  8.10, 10.27,
     & -7.49, -5.05, -2.61,  -.03,  1.98,  4.07,  6.38,  8.65, 10.92,
     & -6.61, -3.97, -1.19,  1.61,  4.00,  6.89,  9.81, 12.73, 15.65,
     & -6.29, -3.04,   .33,  3.26,  6.47,  9.83, 13.19, 16.55, 19.92,
     & -5.98, -2.68,   .67,  4.25,  7.94, 11.72, 15.49, 19.26, 23.04/
      DATA((ALP709(J,N),N=1,9),J=1,13)/
     & -9.55, -7.56, -5.57, -3.58, -1.57,   .54,  3.12,  6.58,  9.54,
     & -9.04, -7.25, -5.46, -3.68, -1.88,   .06,  2.28,  5.61,  8.36,
     & -8.75, -7.08, -5.41, -3.73, -2.06,  -.22,  1.85,  4.60,  7.54,
     & -8.56, -6.96, -5.36, -3.76, -2.16,  -.39,  1.62,  4.21,  6.99,
     & -8.43, -6.89, -5.34, -3.80, -2.25,  -.55,  1.42,  3.80,  7.30,
     & -8.38, -6.82, -5.27, -3.71, -2.16,  -.58,  1.49,  4.05,  8.16,
     & -8.12, -6.60, -5.07, -3.54, -2.02,  -.34,  1.77,  4.69,  9.18,
     & -7.58, -6.09, -4.60, -3.10, -1.60,  -.04,  2.44,  5.87, 10.11,
     & -7.00, -5.54, -4.08, -2.62, -1.02,   .85,  3.53,  6.88, 10.96,
     & -6.38, -4.87, -3.36, -1.84,  -.23,  1.56,  4.74,  8.42, 12.42,
     & -4.89, -3.58, -2.27,  -.75,   .91,  2.95,  6.04, 10.08, 14.12,
     & -3.74, -2.47, -1.10,   .40,  2.11,  4.05,  7.68, 11.72, 15.76,
     & -2.66, -1.40,  -.07,  1.59,  3.39,  5.74,  9.16, 12.67, 16.18/
      DATA((ALP709(J,N),N=1,9),J=14,26)/
     & -1.71,  -.48,   .97,  2.68,  4.77,  7.39, 10.17, 12.94, 15.72,
     & -1.24,  -.05,  1.37,  3.45,  5.64,  8.19, 10.83, 13.48, 16.13,
     & -1.50,  -.17,  1.30,  3.30,  5.53,  8.03, 10.62, 13.22, 15.82,
     & -2.15,  -.83,   .60,  2.28,  4.68,  6.89,  9.39, 11.89, 14.39,
     & -2.78, -1.57,  -.28,  1.43,  3.34,  5.52,  7.57,  9.56, 11.55,
     & -3.42, -2.25,  -.78,   .89,  2.82,  4.88,  7.11,  9.59, 12.07,
     & -4.06, -2.61,  -.92,   .95,  2.90,  4.96,  7.33, 10.05, 12.78,
     & -4.79, -2.80,  -.83,  1.10,  3.09,  5.17,  7.64, 10.32, 13.01,
     & -4.94, -2.80,  -.76,  1.23,  3.27,  5.41,  7.96, 10.64, 13.33,
     & -4.87, -2.73,  -.67,  1.36,  3.45,  5.66,  8.28, 10.97, 13.65,
     & -4.56, -2.22,  -.17,  2.27,  4.77,  7.48, 10.52, 13.55, 16.58,
     & -4.39, -1.90,   .18,  3.21,  6.15,  9.40, 12.65, 15.90, 19.15,
     & -4.15, -1.89,   .55,  4.12,  7.76, 11.18, 14.60, 18.02, 21.44/
      DATA((ALP712(J,N),N=1,9),J=1,13)/
     & -9.27, -7.25, -5.23, -3.21, -1.09,  1.11,  3.72,  7.33, 11.50,
     & -9.23, -7.31, -5.38, -3.46, -1.48,   .68,  3.03,  5.91, 10.17,
     & -9.18, -7.31, -5.44, -3.57, -1.66,   .43,  2.67,  5.25,  8.99,
     & -9.22, -7.37, -5.52, -3.67, -1.79,   .27,  2.52,  5.01,  8.35,
     & -8.85, -7.06, -5.26, -3.47, -1.65,   .39,  2.97,  5.74,  9.42,
     & -8.39, -6.65, -4.90, -3.15, -1.31,  1.00,  4.31,  6.90, 10.50,
     & -8.23, -6.36, -4.48, -2.60,  -.47,  2.54,  5.44,  8.24, 11.22,
```

```
& -7.75, -5.64, -3.54, -1.39,  1.20,  4.31,  6.73,  9.69, 12.65,
& -6.55, -4.36, -2.17,   .13,  2.99,  5.42,  8.18, 11.12, 14.06,
& -5.26, -2.97,  -.64,  1.91,  4.31,  6.69,  9.57, 12.45, 15.32,
& -3.79, -1.44,   .99,  3.23,  5.41,  8.10, 10.96, 13.81, 16.67,
& -2.21,   .21,  2.36,  4.31,  6.65,  9.49, 12.33, 15.16, 18.00,
& -1.16,  1.19,  3.13,  5.15,  7.97, 11.27, 14.58, 17.88, 21.19/
 DATA((ALP712(J,N),N=1,9),J=14,26)/
&  -.77,  1.47,  3.39,  5.44,  8.37, 11.60, 14.82, 18.05, 21.27,
& -1.39,  1.05,  2.94,  4.87,  7.65, 11.32, 14.99, 18.66, 22.33,
& -2.67,  -.38,  1.59,  3.48,  5.44,  7.96, 10.70, 13.44, 16.18,
& -3.86, -1.75,   .32,  2.34,  4.26,  6.24,  9.01, 11.79, 14.57,
& -4.70, -2.43,  -.01,  2.05,  4.00,  6.08,  8.88, 11.68, 14.48,
& -4.96, -2.50,  -.04,  2.13,  4.07,  6.31,  9.03, 11.76, 14.48,
& -4.94, -2.47,   .03,  2.21,  4.19,  6.54,  9.27, 11.99, 14.71,
& -4.93, -2.43,   .10,  2.29,  4.34,  6.77,  9.53, 12.29, 15.05,
& -4.91, -2.38,   .17,  2.39,  4.51,  7.01,  9.77, 12.52, 15.28,
& -4.88, -2.32,   .24,  2.48,  4.67,  7.24, 10.04, 12.84, 15.64,
& -4.77, -2.07,   .54,  3.12,  5.77,  8.79, 11.85, 14.90, 17.95,
& -4.62, -2.09,   .71,  3.76,  6.87, 10.20, 13.53, 16.87, 20.20,
& -4.53, -2.06,   .92,  4.52,  8.09, 11.66, 15.23, 18.80, 22.38/
 DATA((CD706(I,J),J=1,26),I=1,5)/
1 .0265, .0282, .0288, .0291, .0294, .0296, .0297, .0300, .0317,
1 .0350, .0393, .0435, .0483, .0535, .0586, .0637, .0689, .0740,
1 .0766, .0782, .0798, .0805, .0812, .0749, .0600, .0497,
2 .0177, .0183, .0185, .0186, .0187, .0185, .0189, .0199, .0221,
2 .0259, .0308, .0356, .0402, .0447, .0493, .0540, .0588, .0633,
2 .0671, .0709, .0747, .0774, .0797, .0778, .0684, .0582,
3 .0080, .0082, .0085, .0086, .0090, .0094, .0100, .0108, .0124,
3 .0157, .0201, .0244, .0300, .0374, .0448, .0529, .0615, .0687,
3 .0739, .0784, .0817, .0851, .0875, .0920, .0911, .0901,
4 .0067, .0068, .0069, .0069, .0069, .0070, .0073, .0081, .0092,
4 .0112, .0136, .0195, .0267, .0349, .0466, .0588, .0691, .0769,
4 .0847, .0901, .0953, .1006, .1047, .1223, .1371, .1512,
5 .0067, .0068, .0068, .0069, .0069, .0069, .0074, .0084, .0109,
5 .0139, .0187, .0263, .0389, .0547, .0719, .0889, .1051, .1208,
5 .1349, .1470, .1560, .1621, .1681, .1998, .2300, .2478/
 DATA((CD709(I,J),J=1,26),I=1,5)/
1 .0245, .0304, .0333, .0348, .0363, .0374, .0386, .0410, .0439,
1 .0488, .0537, .0586, .0635, .0684, .0733, .0790, .0854, .0919,
1 .0983, .1023, .1042, .1060, .1063, .1021, .0878, .0696,
2 .0140, .0170, .0189, .0200, .0211, .0217, .0225, .0261, .0308,
2 .0355, .0402, .0450, .0502, .0553, .0604, .0655, .0705, .0755,
2 .0805, .0855, .0898, .0908, .0918, .0907, .0853, .0730,
3 .0093, .0096, .0100, .0102, .0104, .0106, .0128, .0179, .0231,
3 .0283, .0334, .0397, .0470, .0542, .0617, .0698, .0779, .0859,
3 .0925, .0980, .1034, .1068, .1083, .1084, .1063, .1024,
4 .0076, .0078, .0078, .0078, .0081, .0083, .0105, .0132, .0180,
4 .0241, .0301, .0362, .0423, .0528, .0665, .0802, .0936, .1042,
4 .1148, .1233, .1285, .1336, .1388, .1492, .1529, .1551,
5 .0077, .0077, .0078, .0079, .0080, .0082, .0110, .0158, .0205,
5 .0253, .0360, .0481, .0602, .0723, .0899, .1097, .1295, .1475,
5 .1644, .1813, .1957, .2029, .2101, .2435, .2569, .2654/
 DATA((CD712(I,J),J=1,26),I=1,5)/
1 .0221, .0315, .0362, .0386, .0426, .0454, .0492, .0530, .0568,
1 .0606, .0666, .0734, .0802, .0872, .0952, .1032, .1112, .1196,
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     1 .1283, .1371, .1441, .1457, .1473, .1408, .1201, .0934,
     2 .0130, .0146, .0154, .0161, .0176, .0195, .0242, .0325, .0403,
     2 .0470, .0544, .0620, .0709, .0807, .0905, .0998, .1091, .1184,
     2 .1272, .1348, .1423, .1480, .1504, .1474, .1252, .0990,
     3 .0110, .0113, .0118, .0120, .0128, .0150, .0201, .0265, .0330,
     3 .0418, .0505, .0594, .0709, .0825, .0940, .1044, .1148, .1253,
     3 .1350, .1447, .1541, .1589, .1637, .1600, .1469, .1324,
     4 .0099, .0099, .0099, .0099, .0099, .0110, .0162, .0222, .0284,
     4 .0378, .0476, .0574, .0701, .0849, .0997, .1147, .1297, .1434,
     4 .1568, .1696, .1778, .1861, .1909, .1992, .1923, .1824,
     5 .0099, .0099, .0099, .0099, .0103, .0126, .0182, .0239, .0367,
     5 .0499, .0661, .0836, .1023, .1198, .1367, .1508, .1637, .1766,
     5 .1891, .2012, .2134, .2245, .2346, .2764, .2948, .3025/
      DATA(XMI(J),J=1,26)/.3,.5,.6,.65,.7,.725,.75,.775,
     & .8,.825,.85,.875,.9,.925,.95,.975,1.0,1.025,1.05,1.075,
     &1.1,1.125,1.15,1.3,1.45,1.6/
      DATA(CLI(J),J=1,9)/-.4,-.2,0.0,.2,.4,.6,.8,1.0,1.2/
      DATA(ALPI(J),J=1,7)/-4.0,-2.0,0.0,2.0,4.0,6.0,8.0/
      DATA(CLII(J),J=1,5)/0.0,.2,.4,.6,.8/
      IORDER(1)=IORDER(2)=1
      IPT (1) = -1
      IF (IKEY .EQ. 2) GO TO 1000
      IF (TR .LT. .06) GO TO 1
      IF (TR .GE. .06 .AND. TR .LT. .09) GO TO 2
      IF (TR .GE. .09 .AND. TR .LT. .12) GO TO 3
      IF (TR .GE. .12) GO TO 4
    1 CALL IBI (7,ALPI,26,XMI,7,CL706,IORDER,IPT,AA,XM,CLFT06,IERR)
      CL=CLFT06
      GO TO 400
    2 CALL IBI (7,ALPI,26,XMI,7,CL706,IORDER,IPT,AA,XM,CLFT06,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL709,IORDER,IPT,AA,XM,CLFT09,IERR)
      CL=CLFT06 + (CLFT09 - CLFT06)*((TR-.06)/(.09-.06))
      GO TO 400
    3 CALL IBI (7,ALPI,26,XMI,7,CL709,IORDER,IPT,AA,XM,CLFT09,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL712,IORDER,IPT,AA,XM,CLFT12,IERR)
      CL=CLFT09+(CLFT12-CLFT09)*((TR-.09)/(.12-.09))
      GO TO 400
    4 CALL IBI (7,ALPI,26,XMI,7,CL712,IORDER,IPT,AA,XM,CLFT12,IERR)
      CL=CLFT12
      GO TO 400
 1000 CONTINUE
      IPT (1)=-1
      IF (TR .LT. .06) GO TO 10
      IF (TR .GE. .06 .AND. TR .LT. .09) GO TO 20
      IF (TR .GE. .09 .AND. TR .LT. .12) GO TO 30
      IF (TR .GE. .12) GO TO 40
   10 CALL IBI (26,XMI,9,CLI,26,ALP706,IORDER,IPT,XM,CL,AA06,IERR)
      AA=AA06
      GO TO 400
   20 CALL IBI (26,XMI,9,CLI,26,ALP706,IORDER,IPT,XM,CL,AA06,IERR)
      IPT (1) = -1
      CALL IBI (26,XMI,9,CLI,26,ALP709,IORDER,IPT,XM,CL,AA09,IERR)
      AA=AA06 + (AA09 - AA06)*((TR -.06)/(.09-.06))
```

```
      GO TO 400
   30 CALL IBI (26,XMI,9,CLI,26,ALP709,IORDER,IPT,XM,CL,AA09,IERR)
      IPT (1) = -1
      CALL IBI (26,XMI,9,CLI,26,ALP712,IORDER,IPT,XM,CL,AA12,IERR)
      AA=AA09+(AA12-AA09)*((TR-.09)/(.12-.09))
      GO TO 400
   40 CALL IBI (26,XMI,9,CLI,26,ALP712,IORDER,IPT,XM,CL,AA12,IERR)
      AA=AA12
  400 CONTINUE
      IPT (1)=-1
      IF (TR .LT. .06) GO TO 11
      IF (TR .GE. .06 .AND. TR .LT. .09) GO TO 21
      IF (TR .GE. .09 .AND. TR .LT. .12) GO TO 31
      IF (TR .GE. .12) GO TO 41
   11 CALL IBI (5,CLII,26,XMI,5,CD706,IORDER,IPT,CL,XM,CDRG06,IERR)
      CD=CDRG06
      WRITE (6,206) TR
  206 FORMAT(*0THICKNESS RATIO=*,F5.3,* IS OUT OF RANGE.
     &*/* THE VALUES FOR T/C=.06 HAVE BEEN RETURNED.*)
      GO TO 250
   21 CALL IBI (5,CLII,26,XMI,5,CD706,IORDER,IPT,CL,XM,CDRG06,IERR)
      IPT (1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD709,IORDER,IPT,CL,XM,CDRG09,IERR)
      CD=CDRG06 + (CDRG09 - CDRG06)*((TR-.06)/(.09-.06))
      GO TO 250
   31 CALL IBI (5,CLII,26,XMI,5,CD709,IORDER,IPT,CL,XM,CDRG09,IERR)
      IPT (1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD712,IORDER,IPT,CL,XM,CDRG12,IERR)
      CD=CDRG09+(CDRG12-CDRG09)*((TR-.09)/(.12-.09))
      GO TO 250
   41 CALL IBI (5,CLII,26,XMI,5,CD712,IORDER,IPT,CL,XM,CDRG12,IERR)
      CD=CDRG12
      IF (TR .GT. .12) WRITE (6,207) TR
  207 FORMAT(*0THICKNESS RATIO=*,F5.3,* IS OUT OF RANGE.
     &*/* THE VALUES FOR T/C=.12 HAVE BEEN RETURNED.*)
  250 IF(CL .GT. .8) GO TO 251
      RETURN
  251 CALL COMPUT(D,XM,ALT,COR,TR,AA,CDT,CL,CD,CLDES)
      CD=CDT
      RETURN
      END


      SUBROUTINE IBI(NX,X,NY,Y,MAXF,F,IORDER,IPT,X0,Y0,Z,IERR)
C
C
C*****************************************************************
C*                                                               *
C* PURPOSE                                                       *
C*                                                               *
C*    FIRST OR SECOND ORDER LAGRANGIAN INTEPOLATION FOR A BIVARIATE *
C*    FUNCTION Z = F(X0,Y0).  THE ORDER OF INTERPOLATION IN THE X  *
C*    DIRECTION MAY DIFFER FROM THE ORDER IN THE Y DIRECTION.  VALUES *
C*    IN THE X AND Y ARRAYS NEED NOT BE EQUALLY SPACED, NOR DO THE X *
```

```
C*    AND Y ARRAYS REQUIRE THE SAME NUMBER OF ELEMENTS.  THE X AND Y   *
C*    ARRAYS EACH REQUIRE AT LEAST TWO ELEMENTS FOR FIRST ORDER INTERP-*
C*    OLATION AND AT LEAST THREE POINTS FOR SECOND ORDER INTERPOLATION.*
C*    F MUST BE KNOWN AT THE NODE POINTS (X(I),Y(J)).                  *
C*                                                                     *
C*    THE PROGRAM USES INTERNAL POINTERS IN THE X AND Y DIRECTIONS     *
C*    TO BEGIN SEARCHES.  THESE POINTERS CONTAIN THE INDICES OF THE X  *
C*    AND Y MESH LINES NEAREST THE PREVIOUS (X0,Y0).  THESE POINTERS   *
C*    ARE USED TO MINIMIZE THE SEARCH TIMES BASED ON THE PREMISE THAT  *
C*    IN SCIENTIFIC INTERPOLATION SUCCESSIVE POINTS TO BE INTERPOLATED *
C*    WILL BE FOUND IN THE SAME OR NEARBY GRID RECTANGLES.             *
C*                                                                     *
C* USE                                                                 *
C*                                                                     *
C*    CALL IBI(NX,X,NY,Y,MAXF,F,IORDER,IPT,X0,Y0,Z,IERR)               *
C*                                                                     *
C* PARAMETERS                                                          *
C*                                                                     *
C*    NX-----AN INPUT INTEGER SPECIFYING THE NUMBER OF DATA POINTS FOR  *
C*           THE FIRST INDEPENDENT VARIABLE.                           *
C*                                                                     *
C*    X------ONE INPUT INDEPENDENT VARIABLE ARRAY DIMENSIONED AT LEAST  *
C*           NX IN THE CALLING PROGRAM.  UPON ENTRY TO IBI, X(I) MUST  *
C*           CONTAIN THE I-TH VALUE OF THE FIRST INDEPENDENT VARIABLE  *
C*           AT WHICH THE FUNCTION IS KNOWN.                           *
C*           X MUST BE STRICTLY INCREASING, X(I+1)>X(I).               *
C*                                                                     *
C*    NY-----AN INPUT INTEGER SPECIFYING THE NUMBER OF DATA POINTS FOR  *
C*           THE SECOND INDEPENDENT VARIABLE.                          *
C*                                                                     *
C*    Y------THE OTHER INPUT INDEPENDENT VARIABLE ARRAY DIMENSIONED AT  *
C*        C  LEAST NY IN THE CALLING PROGRAM.  UPON ENTRY TO IBI, Y(J)  *
C*           MUST CONTAIN THE J-TH VALUE OF THE SECOND INDEPENDENT     *
C*           VARIABLE AT WHICH THE FUNCTION IS KNOWN.                  *
C*           Y MUST BE STRICTLY INCREASING, Y(J+1)>Y(J).               *
C*                                                                     *
C*    MAXF---AN INPUT INTEGER GIVING THE MAXIMUM ROW DIMENSION OF F IN  *
C*           THE CALLING PROGRAM.                                      *
C*                                                                     *
C*    F------THE INPUT TABLE OF DEPENDENT VARIABLE (FUNCTIONAL) VALUES  *
C*           DIMENSIONED F(MAXF,NY) IN THE CALLING PROGRAM.  ACTUALLY  *
C*           F MAY HAVE MORE THAN NY COLUMNS BUT NOT MORE THAN MAXF ROW*
C*           UPON ENTRY TO IBI, F(I,J) MUST CONTAIN THE FUNCTIONAL     *
C*           VALUE AT (X(I),Y(J)).                                     *
C*                                                                     *
C*    IORDER-AN INTEGER INPUT ARRAY OF INTERPOLATION ORDERS. DIMENSION  *
C*           IORDER(2).                                                *
C*                                                                     *
C*           IORDER(1)--ORDER OF INTERPOLATION FOR X.                  *
C*                                                                     *
C*           IORDER(2)--ORDER OF INTERPOLATION FOR Y.                  *
C*                                                                     *
C*           =1 FIRST ORDER INTERPOLATION.                             *
C*                                                                     *
C*           =2 SECOND ORDER INTERPOLATION.                            *
```

```
C*
C*     IPT----AN INPUT/OUTPUT INTEGER ARRAY WITH THE FOLLOWING FUNCTIONS
C*            DIMENSION IPT(2).
C*
C*            INPUT--INITIALIZATION OF IBI AND CHECK ARRAYS X AND Y.
C*
C*                   = -1 WHENEVER A NEW X OR Y ARRAY IS INPUT, THIS
C*                        VALUE OF IPT(1) SHOULD BE SPECIFIED BY THE
C*                        USER TO INITIALIZE IBI AND CHECK THAT ARRAY
C*                        X IS STRICTLY INCREASING WITH AT LEAST NX
C*                        POINTS AND ARRAY Y IS STRICTLY INCREASING WITH
C*                        AT LEAST NY POINTS.
C*
C*            OUTPUT-INDEX POINTER.
C*
C*                   IPT(1)-THE X INDEX POINTER.
C*
C*                          = K INDICATES THAT ABS(X0-X(K))<ABS(X0-X(I))
C*                            I=1,...,NX I"K, THAT IS, X(K) IS THE
C*                            NEAREST MESH LINE TO X0.  IF
C*                            EXTRAPOLATION WAS USED (IERR=-3) IPT(1)
C*                            =0 ON RETURN IF X0<X(1) AND IPT(1)=NX IF
C*                            X0>X(NX).  ON THE NEXT CALL K IS USED AS
C*                            THE INDEX OF X WHERE THE SEARCH FOR X0
C*                            BEGINS.
C*
C*                   IPT(2)-THE Y INDEX POINTER.
C*
C*                          = J INDICATES THAT ABS(Y0-Y(J))<ABS(Y0-Y(I))
C*                            I=1,...,NY I"J, THAT IS, Y(J) IS THE
C*                            NEAREST MESH LINE TO Y0.  IF
C*                            EXTRAPOLATION WAS USED (IERR=-3) IPT(2)
C*                            =0 ON RETURN IF Y0<Y(1) AND IPT(2)=NY IF
C*                            Y0>Y(NY).  ON THE NEXT CALL, J IS USED
C*                            AS THE INDEX OF Y WHERE THE SEARCH FOR
C*                            Y0 BEGINS.
C*
C*     X0-----THE INPUT X POINT WHERE INTERPOLATION IS DESIRED.
C*
C*     Y0-----THE INPUT Y POINT WHERE INTERPOLATION IS DESIRED.
C*
C*     Z------THE OUTPUT INTERPOLATED VALUE OF THE FUNCTION AT (X0,Y0),
C*            Z=F(X0,Y0).
C*
C*     IERR---INTEGER OUTPUT ERROR CODE GENERATED AND RETURNED BY IBI.
C*
C*            = 0 NORMAL RETURN.  NO PROBLEMS ENCOUNTERED.
C*
C*            =-1 THE X OR Y ARRAY WAS NOT STRICTLY INCREASING.
C*                NO INTERPOLATION PERFORMED.
C*
C*            =-2 INSUFFICIENT VALUES IN X OR Y TO PERFORM THE ORDER OF
C*                INTERPOLATION REQUESTED, POSSIBLY USER INPUT NX OR NY
C*                INCORRECTLY.  NO INTERPOLATION PERFORMED.
C*
```

```
C*            =-3 EXTRAPOLATION USED.  THE VALUE Z RETURNED MAY BE QUITE*
C*                INACCURATE.                                           *
C*                                                                      *
C*            =-4 IORDER(1) OR IORDER(2) NOT CORRECTLY INPUT BY USER    *
C*                AS 1 OR 2.  NO INTERPOLATION PERFORMED.               *
C*                                                                      *
C*            THE USER SHOULD TEST IERR ON EACH RETURN FROM IBI.        *
C*                                                                      *
C* REQUIRED ROUTINES                                                    *
C*                                                                      *
C*    MONO, FINDER, LAGRAG,INDIXR.                                      *
C*                                                                      *
C*                                                                      *
C* AUTHOR/IMPLEMENTER                                                   *
C*                                                                      *
C*    S. BAUDENDISTEL/G.W. HAIGLER.                                     *
C*                                                                      *
C* LANGUAGE                                                             *
C*                                                                      *
C*    FORTRAN.                                                          *
C*                                                                      *
C* DATE RELEASED                                                        *
C*                                                                      *
C*    AUGUST 15, 1973                                                   *
C*                                                                      *
C* LATEST REVISION                                                      *
C*                                                                      *
C*    AUGUST 15, 1973                                                   *
C*                                                                      *
C************************************************************************
                                                          IBI  15
C
      DIMENSION X(1),Y(1),F(MAXF,1),P(3),S(3),IPT(2),IORDER(2)
C
      IF(IPT(1).NE.-1)GOTO 10
C
C     INITIALIZE AND CHECK X,Y ARRAYS ARE STRICTLY INCREASING.
C
      IERR=-1
      IF(MONO(NX,X,IPT(1)).LT.0)RETURN
      IF(MONO(NY,Y,IPT(2)).LT.0)RETURN
      IPT(1)=IPT(2)=1
C
C     CHECK THAT IORDER(1) AND IORDER(2) ARE 1 OR 2 ONLY.
C
   10 IERR=-4
      IF(IORDER(1).NE.1.AND.IORDER(1).NE.2)RETURN
      IF(IORDER(2).NE.1.AND.IORDER(2).NE.2)RETURN
C
C     CHECK THAT THERE ARE SUFFICIENT POINTS IN X ARRAY TO DO IORDER(1)
C     INTERPOLATION AND SUFFICIENT POINTS IN Y ARRAY TO DO IORDER(2)
C     INTERPOLATION.
C
      IERR=-2
      IF(NX-1.LT.IORDER(1))RETURN
      IF(NY-1.LT.IORDER(2))RETURN
```

```
      IERR=0
C
C     SEARCH FOR THE X AND Y MESH LINES NEAREST TO  X0,Y0 AND RECORD
C     THESE INDICES IN IPT(1) AND IPT(2).
C
      CALL FINDER(X0,X,IPT(1),NX,M,IERR)
      CALL FINDER(Y0,Y,IPT(2),NY,N,IERR)
C
C     OBTAIN INDICES FOR Y DIRECTION INTERPOLATION TABLE LOOK UP.
C
      CALL INDIXR(IPT(2),IORDER(2),Y0,KL,KR,Y,NY)
      KM=KL+1
C
C     DETERMINE THE LAGRANGIAN INTERPOLATING COEFFICIENTS FOR Y
C     DIRECTION INTERPOLATION.
C
      CALL LAGRAG(Y0,Y(KR),Y(KM),Y(KL),P,IORDER(2))
C
C     OBTAIN INDICES FOR X DIRECTION INTERPOLATION TABLE LOOK UP.
C
      CALL INDIXR(IPT(1),IORDER(1),X0,LL,LR,X,NX)
      LM=LL+1
C
C     DETERMINE THE LAGRANGIAN INTERPOLATING COEFFICIENTS FOR X
C     DIRECTION INTERPOLATION.
C
      CALL LAGRAG(X0,X(LR),X(LM),X(LL),S,IORDER(1))
C
C     COMPLETE LAGRANGIAN INTERPOLATION BY COMPUTING THE DOUBLE SUM
C     OF PRODUCTS.
C
      Z=0.
      LP1=0
      DO 30 I=LL,LR
      LP1=LP1+1
      SUM=0.
      KP1=0
      DO 20 J=KL,KR
      KP1=KP1+1
   20 SUM=P(KP1)*F(I,J)+SUM
   30 Z=SUM*S(LP1)+Z
      IF(IERR.GE.0)RETURN
      IPT(1)=M $ IPT(2)=N
      RETURN
      END


      SUBROUTINE COMPUT (D,XM,ALT,COR,TR,ALPHA,CD,CL,CDINPUT,CLDES)
      DIMENSION CDARAY(11,1),CLARAY(6,9),CLMXAR(10,12)
      DIMENSION ALPHA0(11),RN1(3),CLDSIN(4),DELALR(10,3),ALCLMX(10,4)
      DIMENSION IPT(2),IORDER(2)
      DIMENSION TR0(10),RN0(12),CLMAX0(6),DELAL0(9)
      DATA ((CDARAY(I,J),I= 1,11),J=1,1)/  0.00,  0.00,   .07,   .29,
     1 .42,  .53,   .67,   .81,   .96,   1.15,  1.28/
```

```
      DATA ((CLARAY(K,L),K=1,6),L=1,9)  /
     1  0.800,  0.980,  1.200,  1.400,  1.600,  1.800,
     2  1.080,  1.290,  1.380,  1.540,  1.770,  1.985,
     3  1.200,  1.345,  1.415,  1.565,  1.790,  2.010,
     4  1.200,  1.330,  1.405,  1.550,  1.770,  1.990,
     5  1.180,  1.305,  1.380,  1.520,  1.745,  1.960,
     6  1.175,  1.290,  1.365,  1.505,  1.725,  1.940,
     7  1.170,  1.280,  1.355,  1.495,  1.710,  1.925,
     8  1.170,  1.270,  1.345,  1.490,  1.700,  1.915,
     9  1.170,  1.260,  1.335,  1.480,  1.690,  1.905/
      DATA  ((CLMXAR(M,N),M=1,10),N=1,12)  /
     1 .750, .750, .750, .752,  .760,  .790,  .820,  .832,  .840,  .840,
     2 .750, .750, .750, .760,  .790,  .835,  .860,  .870,  .872,  .870,
     3 .750, .750, .760, .780,  .840,  .895,  .920,  .930,  .930,  .920,
     4 .750, .750, .760, .790,  .900,  .965,  .990, 1.000, 1.000,  .990,
     5 .750, .750, .760, .800,  .960, 1.045, 1.075, 1.078, 1.063, 1.040,
     6 .750, .750, .768, .825, 1.010, 1.110, 1.140, 1.140, 1.120, 1.080,
     7 .750, .750, .770, .850, 1.080, 1.205, 1.240, 1.235, 1.200, 1.135,
     8 .760, .760, .820, .870, 1.110, 1.245, 1.280, 1.270, 1.230, 1.160,
     9 .770, .775, .795, .905, 1.145, 1.265, 1.300, 1.290, 1.255, 1.200,
     * .800, .800, .825, .950, 1.175, 1.285, 1.320, 1.320, 1.300, 1.270,
     1 .800, .800, .870, .995, 1.200, 1.300, 1.335, 1.340, 1.330, 1.315,
     2 .815, .820, .945,1.095, 1.245, 1.350, 1.380, 1.375, 1.360, 1.350/
      DATA ((DELALR(I,J),I= 1,10),J= 1,3)    /
     1  -2.2, -1.5, -1.1, -1.2, -2.3, -4., -4., -4., -4., -4.,
     2  0., 0., -.6, -1.2, -1.1, -.2, 0., -.2, -1.7, -4.,
     3  0., 0., 0., .4, 1.05, .65, 0., -.2, -1.7, -4./
      DATA ((ALCLMX(I,J),I=1,10),J=1,4)   /
     1  9.,  9., 9.5, 10.9, 13., 15.3, 16.4, 19., 18.2, 20.0,
     2 10., 10., 10.2, 11.5, 14.2, 16., 17., 17.7, 19., 10.8,
     3 11., 11., 11., 12.3, 14.8, 16.6, 17.8, 18.7, 20., 21.8,
     4 11.8, 11.6, 11.6, 13., 15.5, 17.3, 18.5, 19.5, 20.6, 22.4/
      DATA RN1 /1., 3., 9./
      DATA CLDSIN / 0., .2, .4, .6/
      DATA TR0 /  .04,  .06,  .08,  .10,  .12,  .14,  .16,  .18,
     1  .20,  .22/
      DATA RN0 /  1.0,  1.2,  1.4,  1.6,  1.8,  2.0,  2.5,  3.0,
     1  4.0,  5.0,  6.0,  9.0/
      DATA CLMAX0 /   .8,  1.0,  1.2,  1.4,  1.6,  1.8/
      DATA DELAL0 /   0.,   4.0,   8.,  12.,  16.,  20., 24.,  28.,
     1  32./
      DATA ALPHA0 /0., 5., 10., 15., 20., 25., 30., 35., 40.,
     1 45., 50./
      IORDER(1)= IORDER(2)= 1
      CALL ATMOS (ALT,RHO,SOS,T)
      V= XM*SOS
      CHORD= COR*D/2.
C     XMUU= MU, BUT MU SHOULD BE DIVIDED BY 1 MILLION
C       ALSO REYNOLDS NUMBER WILL BE 1 MILLIONTH OF ITS ACTUAL VALUE
      XMUU= (.1E-09)*.3170*T**1.5*734.7/(T +216.)
      RN= (RHO*V*CHORD)/XMUU/(.1E 07)
      IPT(1)= -1
      CALL IBI (10,TR0,12,RN0,10,CLMXAR,IORDER,IPT,TR,RN,CLMAX,IERR)
      IPT(1)= -1
      CALL IBI (10,TR0,3,RN1,10,DELALR,IORDER,IPT,TR,RN,
```

```
     1DALPRN,IERR)
      IPT(1)= -1
      CALL IBI (10,TR0,4,CLDSIN,10,ALCLMX,IORDER,IPT,
     1TR,CLDES,APCLMX,IERR)
      ALPCLM= APCLMX +DALPRN
      DELALP= ALPHA -ALPCLM
      IPT(1)= -1
      IF (DELALP.LE.0.0) GO TO 48
      WRITE(6,400)ALPHA
  400 FORMAT(*0*,F6.3,* IS AT OR BEYOND STALL.*/)
      CALL IBI (6,CLMAX0,9,DELAL0,6,CLARAY,IORDER,IPT,CLMAX,
     1DELALP,CL,IERR)
      IPT(1)= -1
   48 CONTINUE
      IF (ALPHA.LT.8.0) GO TO 50
      CALL IUNI (11,11,ALPHA0,1,CDARAY,IORDER,ALPHA,DELCD,IPT,IERR)
      CD= CDINPUT +DELCD
      RETURN
   50 CONTINUE
      CD= CDINPUT
      RETURN
      END



      SUBROUTINE ATMOS(ALT,RHO,SOS,T0)
C     INPUT:
C          ALTITUDE IN FEET; GEOPOTENTIAL.
C     OUTPUT:
C          T0= AMBIENT STATIC TEMPERATURE, DEG.,R.
C          P0= AMBIENT STATIC PRESSURE, PSF.
C          RHO= AMBIENT STATIC DENSITY, SLUGS/CUBIC FOOT.
C          SOS= SPEED OF SOUND IN FEET PER SECOND.
C
      DELTT=0.0
      XL=0.003567
      T00=518.69+DELTT
      T0=T00*(1.0-XL*ALT/T00)
      IF(ALT.GT.80000.0) WRITE 300
  300 FORMAT(1H0,50H BECAUSE THE ALTITUDE IS GREATER THAN 80 000 FEET,/
     161H CALCULATIONS CANNOT BE CARRIED OUT WITH SUFFICIENT ACCURACY.)
      IF(ALT.GT.36089.0)T0=T00*0.7518
      P0=2116.2*(1.0-XL*ALT/T00)**5.259805
      IF(ALT.GT.36089.0)P0=470.8563*(EXP((36089.0-ALT)/(53.3*T0)))
      RHO=P0/(53.3*32.2*T0)
      SOS=SQRT(1.4*53.3*32.2*T0)
      RETURN
      END



      FUNCTION MONO(M,VAR,IPOS)
C
C  FUNCTION MONO CHECKS TO INSURE THAT THE SEQUENCE VAR IS STRICTLY
C  INCREASING.  IF VAR IS A STRICTLY INCREASING SEQUENCE MONO RETURNS
```

```
C  A POSITIVE VALUE.  IF VAR IS NOT A STRICTLY INCREASING SEQUENCE,
C  MONO RETURNS A NEGATIVE VALUE AND THE INDEX OF VAR WHERE VAR(N)
C  WAS NOT STRICTLY INCREASING.
C
C     M----THE NUMBER OF ELEMENTS IN VAR.
C
C     VAR--THE X,Y, OR Z ARRAY PASSED FROM IBI OR ITRI.
C
C     IPOS-IPT(1),IPT(2),OR IPT(3).
C
      DIMENSION VAR(M)
C
      MONO=1
      K=M-1
      DO 10 L=1,K
      N=L+1
      IF(VAR(N)-VAR(L).GT.0.)GOTO 10
      MONO=-1
      IPOS=N
   10 CONTINUE
      RETURN
      END


      SUBROUTINE FINDER(S,VAR,IPOS,NBND,IF,IERR)
C
C  FINDER DETERMINES THE INDEX OF THE X,Y, OR Z ARRAY(VAR) NEAREST TO
C  X0,Y0, OR Z0 (S).  IF S<VAR(1) OR S>VAR(NBND) IERR=-3 ON RETURN
C  AND IF CONTAINS A 0 OR NBND ACCORDING TO THE SITUATION, WHILE
C  IPOS RETURNS A 1 OR NBND.
C
C     S----X0,Y0, OR Z0.
C
C     VAR--X,Y, OR Z.
C
C     IPOS-IPT(1),IPT(2), OR IPT(3).  THE INDEX OF VAR NEAREST TO S.
C
C     NBND-THE NUMBER OF VALUES IN VAR.
C
C     IF---IPOS IF  VAR(1)@S@VAR(NBND).
C
C          0    IF  VAR(1)>S.
C
C          NBND IF  VAR(NBND)<S.
C
C     IERR-0    IF  VAR(1)@S@VAR(NBND).
C
C          -3   IF  VAR(1)>S OR VAR(NBND)<S.
C
      DIMENSION VAR(1)
C
      LOGICAL ABOVE,BELOW
      ABOVE=BELOW=.FALSE.
      IF(IPOS.EQ.0)IPOS=1
```

```
   10 IF(S-VAR(IPOS))20,50,30
   20 ABOVE=.TRUE.
      IUP=IPOS
      IF(ABOVE.AND.BELOW)GOTO 40
      IPOS=IPOS-1
      IF(IPOS.GE.1)GOTO 10
      IERR=-3
      IPOS=1
      IF=0
      RETURN
   30 BELOW=.TRUE.
      LOW=IPOS
      IF(ABOVE.AND.BELOW)GOTO 40
      IPOS=IPOS+1
      IF(IPOS.LE.NBND)GOTO 10
      IERR=-3
      IF=IPOS=NBND
      RETURN
   40 IPOS=LOW
      IF(ABS(S-VAR(IUP)).LT.ABS(S-VAR(LOW)))IPOS=IUP
   50 IF=IPOS
      RETURN
      END


      SUBROUTINE LAGRAG(S,VAR1,VAR2,VAR3,Q,IORDER)
C
C  LAGRAG CALCULATES THE LAGRANGIAN COEFFICIENTS FOR FIRST OR SECOND
C  ORDER INTERPOLATION.
C
C     IORDER-IORDER(1),IORDER(2), OR IORDER(3).
C
C     S------X0,Y0, OR Z0.
C
C     Q------THE LAGRANGIAN COEFFICIENTS.
C
C     VAR1---THE VALUE OF X,Y, OR Z AT RIGHT END POINT OF INTERVAL.
C
C     VAR2---THE VALUE OF X,Y, OR Z AT MID-POINT OF INTERVAL(2-ND ORDER)
C
C     VAR3---THE VALUE OF X,Y, OR Z AT LEFT END POINT OF INTERVAL.
C
      DIMENSION Q(3)
C
      IF(IORDER.EQ.2)GOTO 10
C
C     FIRST ORDER COEFFICIENTS.
C
      T1=VAR3-VAR1
      T2=S-VAR1
      T3=S-VAR3
      Q(1)=T2/T1
      Q(2)=-T3/T1
      RETURN
```

```
C                                                                       ]
C      SECOND ORDER COEFFICIENTS.                                       ]
C                                                                       ]
   10  T1=S-VAR2                                                        ]
       T2=S-VAR1                                                        ]
       T3=S-VAR3                                                        ]
       Q(1)=T1*T2                                                       ]
       Q(2)=T3*T2                                                       ]
       Q(3)=T3*T1                                                       ]
       T1=VAR3-VAR2                                                     ]
       T2=VAR3-VAR1                                                     ]
       T3=VAR2-VAR1                                                     ]
       Q(1)=Q(1)/(T1*T2)                                                ]
       Q(2)=Q(2)/(-T1*T3)                                               ]
       Q(3)=Q(3)/(T2*T3)                                                ]
       RETURN                                                           ]
       END                                                              ]


       SUBROUTINE INDIXR(IPT,IORDER,S,IL,IR,VAR,N)                      ]
C                                                                       ]
C  INDIXR DETERMINES THE INDICES OF THE X,Y, Z ARRAY PASSED TO ARRAY VAR]
C  TO BE USED IN TABLE LOOK UP.                                         ]
C                                                                       ]
C      IPT----THE X,Y,Z POINTER.                                        ]
C                                                                       ]
C      IORDER-THE ORDER OF INTERPOLATION IN X,Y, Z DIRECTION            ]
C                                                                       ]
C      S------X0,Y0,Z0.                                                 ]
C                                                                       ]
C      IL-----THE INDEX OF ARRAY X,Y, OR Z GIVING THE LEFT E D POINT OF ]
C             THE INTERVAL CONTAINING S.                                ]
C                                                                       ]
C      IR-----THE INDEX OF THE X,Y, OR Z ARRAY GIVING THE RI HT END POINT]
C             OF THE INTERVAL CONTAINING S.                             ]
C                                                                       ]
C      VAR----THE X,Y, OR Z ARRAY.                                      ]
C                                                                       ]
C      N------NX,NY, OR NZ.                                             ]
C                                                                       ]
       DIMENSION VAR(1)                                                 ]
C                                                                       ]
       IF(S.LE.VAR(2))GOTO 10                                           ]
       IF(S.GE.VAR(N-1))GOTO 20                                         ]
       IL=IPT                                                           ]
       IF(S.LE.VAR(IPT))IL=IL-1                                         ]
       IF(IORDER.LT.2)GOTO 30                                           ]
       IF(ABS(S-VAR(IL-1)).LT.ABS(S-VAR(IL+2)))IL=IL-1                  ]
       GOTO 30                                                          ]
   10  IL=1                                                             ]
       GOTO 30                                                          ]
   20  IL=N-IORDER                                                      ]
   30  IR=IL+IORDER                                                     ]
       RETURN                                                           ]
```

```
      END


      SUBROUTINE IUNI(NMAX,N,X,NTAB,Y,IORDER,X0,Y0,IPT,IERR)
C     E1.1
C*****************************************************************************
C*                                                                           *
C*    PURPOSE:                                                               *
C*                SUBROUTINE IUNI USES FIRST OR SECOND ORDER                 *
C*                LAGRANGIAN INTERPOLATION TO ESTIMATE THE VALUES            *
C*                OF A SET OF A SET OF FUNCTIONS AT A POINT X0.  IUNI        *
C*                USES ONE INDEPENDENT VARIABLE TABLE AND A DEPENDENT        *
C*                VARIABLE TABLE FOR EACH FUNCTION TO BE EVALUATED.          *
C*                THE ROUTINE ACCEPTS THE INDEPENDENT VARIABLES SPACED       *
C*                AT EQUAL OR UNEQUAL INTERVALS.  EACH DEPENDENT             *
C*                VARIABLE TABLE MUST CONTAIN FUNCTION VALUES CORRES-        *
C*                PONDING TO EACH X(I) IN THE INDEPENDENT VARIABLE           *
C*                TABLE.  THE ESTIMATED VALUES ARE RETURNED IN THE Y0        *
C*                ARRAY WITH THE N-TH VALUE OF THE ARRAY HOLDING THE         *
C*                VALUE OF THE N-TH FUNCTION VALUE EVALUATED AT X0.          *
C*                                                                           *
C*        USE:                                                               *
C*                CALL IUNI(NMAX,N,X,NTAB,Y,IORDER,X0,Y0,IPT,IERR)           *
C*                                                                           *
C* PARAMETERS:                                                               *
C*                                                                           *
C*        NMAX    THE MAXIMUM NUMBER OF POINTS IN THE INDEPENDENT            *
C*                VARIABLE ARRAY.                                            *
C*                                                                           *
C*          N     THE ACTUAL NUMBER OF POINTS IN THE INDEPENDENT             *
C*                ARRAY,WHERE N .LE. NMAX.                                   *
C*                                                                           *
C*          X     A ONE-DIMENSIONAL ARRAY, DIMENSIONED (NMAX) IN THE         *
C*                CALLING PROGRAM, WHICH CONTAINS THE INDEPENDENT            *
C*                VARIABLES.  THESE VALUES MUST BE STRICTLY MONOTONIC.       *
C*                                                                           *
C*        NTAB    THE NUMBER OF DEPENDENT VARIABLE TABLES                    *
C*                                                                           *
C*          Y     A TWO-DIMENSIONAL ARRAY DIMENSIONED (NMAX,NTAB) IN         *
C*                THE CALLING PROGRAM.  EACH COLUMN OF THE ARRAY             *
C*                CONTAINS A DEPENDENT VARIABLE TABLE                        *
C*                                                                           *
C*      IORDER    INTERPOLATION PARAMETER SUPPLIED BY THE USER.              *
C*                                                                           *
C*                =0  ZERO ORDER INTERPOLATION: THE FIRST FUNCTION           *
C*                    VALUE IN EACH DEPENDENT VARIABLE TABLE IS              *
C*                    ASSIGNED TO THE CORRESPONDING MEMBER OF THE Y0         *
C*                    ARRAY.  THE FUNCTIONAL VALUE IS ESTIMATED TO           *
C*                    REMAIN CONSTANT AND EQUAL TO THE NEAREST KNOWN         *
C*                    FUNCTION VALUE.                                        *
C*                                                                           *
C*          X0    THE INPUT POINT AT WHICH INTERPOLATION WILL BE             *
C*                PERFORMED.                                                 *
C*                                                                           *
```

```
C*          Y0     A ONE-DIMENSIONAL ARRAY DIMENSIONED (NTAB) IN THE    *
C*                 CALLING PEOGRAM.  UPON RETURN THE ARRAY CONTAINS THE *
C*                 ESTIMATED VALUE OF EACH FUNCTION AT X0.              *
C*                                                                      *
C*          IPT    ON THE FIRST CALL IPT MUST BE INITIALIZED TO -1 SO   *
C*                 THAT MONOTONICITY WILL BE CHECKED. UPON LEAVING THE  *
C*                 ROUTINE IPT EQUALS THE VALUE OF THE INDEX OF THE X   *
C*                 VALUE PRECEDING X0 UNLESS EXTRAPOLATION WAS          *
C*                 PERFORMED.  IN THAT CASE THE VALUE OF IPT IS         *
C*                 RETURNED AS:                                         *
C*                 =0  DENOTES X0 .LT. X(1) IF THE X ARRAY IS IN        *
C*                     INCREASING ORDER AND X(1) .GT. X0 IF THE X ARRAY *
C*                     IS IN DECREASING ORDER.                          *
C*                 =N  DENOTES X0 .GT. X(N) IF THE X ARRAY IS IN        *
C*                     INCREASING ORDER AND X0 .LT. X(N) IF THE X ARRAY *
C*                     IS IN DECREASING ORDER.                          *
C*                                                                      *
C*                 ON SUBSEQUENT CALLS, IPT IS USED AS A POINTER TO     *
C*                 BEGIN THE SEARCH FOR X0.                             *
C*                                                                      *
C*          IERR   ERROR PARAMETER GENERATED BY THE ROUTINE             *
C*                 =0  NORMAL RETURN                                    *
C*                 =J  THE J-TH ELEMENT OF THE X ARRAY IS OUT OF ORDER  *
C*                 =-1 ZERO ORDER INTERPOLATION PERFORMED BECAUSE       *
C*                     IORDER =0.                                       *
C*                 =-2 ZERO ORDER INTERPOLATION PERFORMED BECAUSE ONLY   *
C*                     ONE POINT WAS IN X ARRAY.                        *
C*                 =-3 NO INTERPOLATION WAS PERFORMED BECAUSE           *
C*                     INSUFFICIENT POINTS WERE SUPPLIED FOR SECOND     *
C*                     ORDER INTERPOLATION.                             *
C*                 =-4 EXTRAPOLATION WAS PERFORMED                      *
C*                                                                      *
C*                 UPON RETURN THE PARAMETER IERR SHOULD BE TESTED IN   *
C*                 THE CALLING PROGRAM.                                 *
C*                                                                      *
C*    REQUIRED ROUTINES                NONE                             *
C*                                                                      *
C*    SOURCE                           CMPB ROUTINE MTLUP MODIFIED      *
C*                                     BY COMPUTER SCIENCES CORPORATION *
C*                                                                      *
C*    LANGUAGE                         FORTRAN                          *
C*                                                                      *
C*                                                                      *
C*    DATE RELEASED                    AUGUST 1,1973                    *
C*                                                                      *
C*    LATEST REVISION                  AUGUST 1,1973                    *
C*                                                                      *
C************************************************************************
      DIMENSION X(1),Y(NMAX,1),Y0(1)
      NM1=N-1
      IERR=0
      J=1
      DELX=X(2)-X(1)
C
C               TEST FOR ZERO ORDER INTERPOLATION
```

```
C
      IF (IORDER .EQ. 0) GO TO 10
      IF (N.LT. 2) GO TO 20
      GO TO 50
  10  IERR=-1
      GO TO 30
  20  IERR=-2
  30  DO 40 NT=1,NTAB
         Y0(NT)=Y(1,NT)
  40     CONTINUE
      RETURN
  50  IF (IPT .GT. -1) GO TO 65
C
C              CHECK FOR TABLE OF NODE POINTS BEING STRICTLY MONOTONIC
C              THE SIGN OF DELX SIGNIFIES WHETHER TABLE IS IN
C              INCREASING OR DECREASING ORDER.
C
      IF (DELX .EQ. 0) GO TO 190
      IF (N .EQ. 2) GO TO 65
C
C              CHECK FOR SIGN CONSISTENCY IN THE DIFFERENCES OF
C              SUBSEQUENT PAIRS
C
      DO 60 J=2,NM1
         IF (DELX * (X(J+1)-X(J))) 190,190,60
  60     CONTINUE
C
C              IPT IS INITIALIZED TO BE WITHIN THE INTERVAL
C
  65  IF (IPT .LT. 1) IPT=1
      IF (IPT .GT. NM1) IPT=NM1
      IN= SIGN (1.0,DELX *( X0-X(IPT)))
  70  P= X(IPT) - X0
      IF (P* (X(IPT +1)- X0)) 90,180,80
  80  IPT =IPT +IN
C
C              TEST TO SEE IF IT IS NECCESARY TO EXTRAPOLATE
C
      IF (IPT.GT.0 .AND. IPT .LT. N) GO TO 70
      IERR=-4
      IPT=IPT- IN
C
C              TEST FOR ORDER OF INTERPOLATION
C
C
  90  IF (IORDER .GT. 1) GO TO 120
C
C              FIRST ORDER INTERPOLATION
C
      DO 100 NT=1,NTAB
          Y0(NT)=Y(IPT,NT)+((Y(IPT+1,NT)- Y(IPT,NT))*(X0-X(IPT)))/
     1           (X(IPT+1)-X(IPT))
 100     CONTINUE
      IF (IERR .EQ. -4) IPT=IPT+IN
      RETURN
```

```
C
C               SECOND ORDER INTERPOLATION
C
 120  IF (N .EQ. 2) GO TO 200
C
C               CHOOSING A THIRD POINT SO AS TO MINIMIZE THE DISTANCE
C               BETWEEN THE THREE POINTS USED TO INTERPOLATE
C
      IF (IPT .EQ. NM1) GO TO  140
      IF (IPT .EQ. 1) GO TO 130
      IF (DELX *(X0-X(IPT-1)).LT.DELX* (X(IPT+2)-X0)) GO TO 140
 130  L=IPT
      GO TO 150
 140  L=IPT -1
 150  V1=X(L)-X0
      V2=X(L+1)-X0
      V3=X(L+2)-X0
      DO 160 NT=1,NTAB
      YY1=(Y(L,NT) * V2 - Y(L+1,NT) * V1)/(X(L+1) - X(L))
      YY2=(Y(L+1,NT)*V3-Y(L+2,NT) *V2)/(X(L+2)-X(L+1))
 160  Y0(NT)=(YY1*V3 -YY2*V1)/(X(L+2)-X(L))
      IF (IERR .EQ. -4) IPT=IPT + IN
      RETURN
 180  IF(P .NE. 0) IPT=IPT +1
      DO 185 NT=1,NTAB
         Y0(NT)=Y(IPT,NT)
 185     CONTINUE
      RETURN
C
C               IERR IS SET TO THE SUBSCRIPT OF THE MEMBER OF THE TABLE
C               WHICH IS OUT OF ORDER
C
 190  IERR=J +1
      RETURN
 200  IERR=-3
      RETURN
      END
```

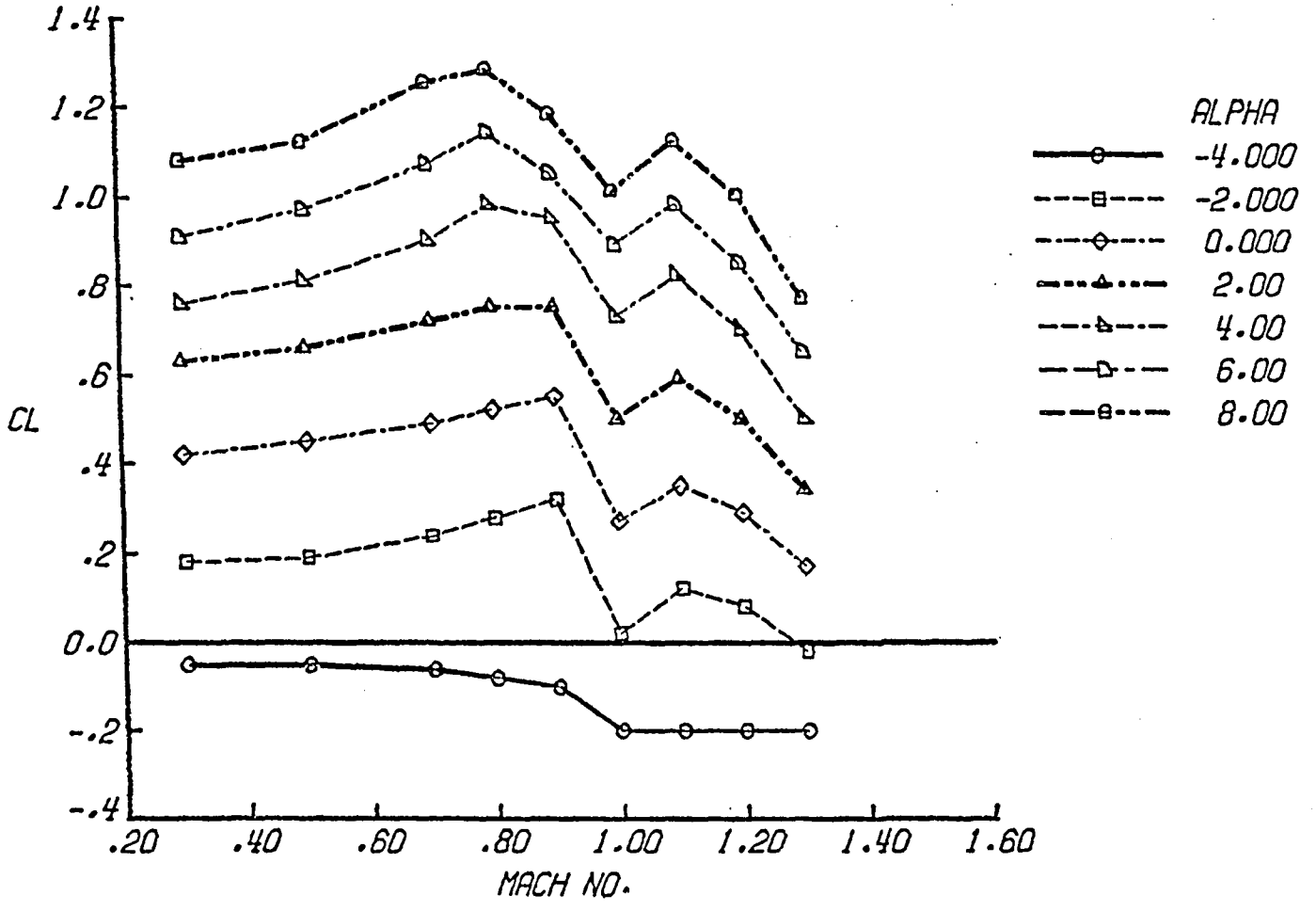

Figure 1.- Data points in lift coefficient table for 16-504, preliminary program.

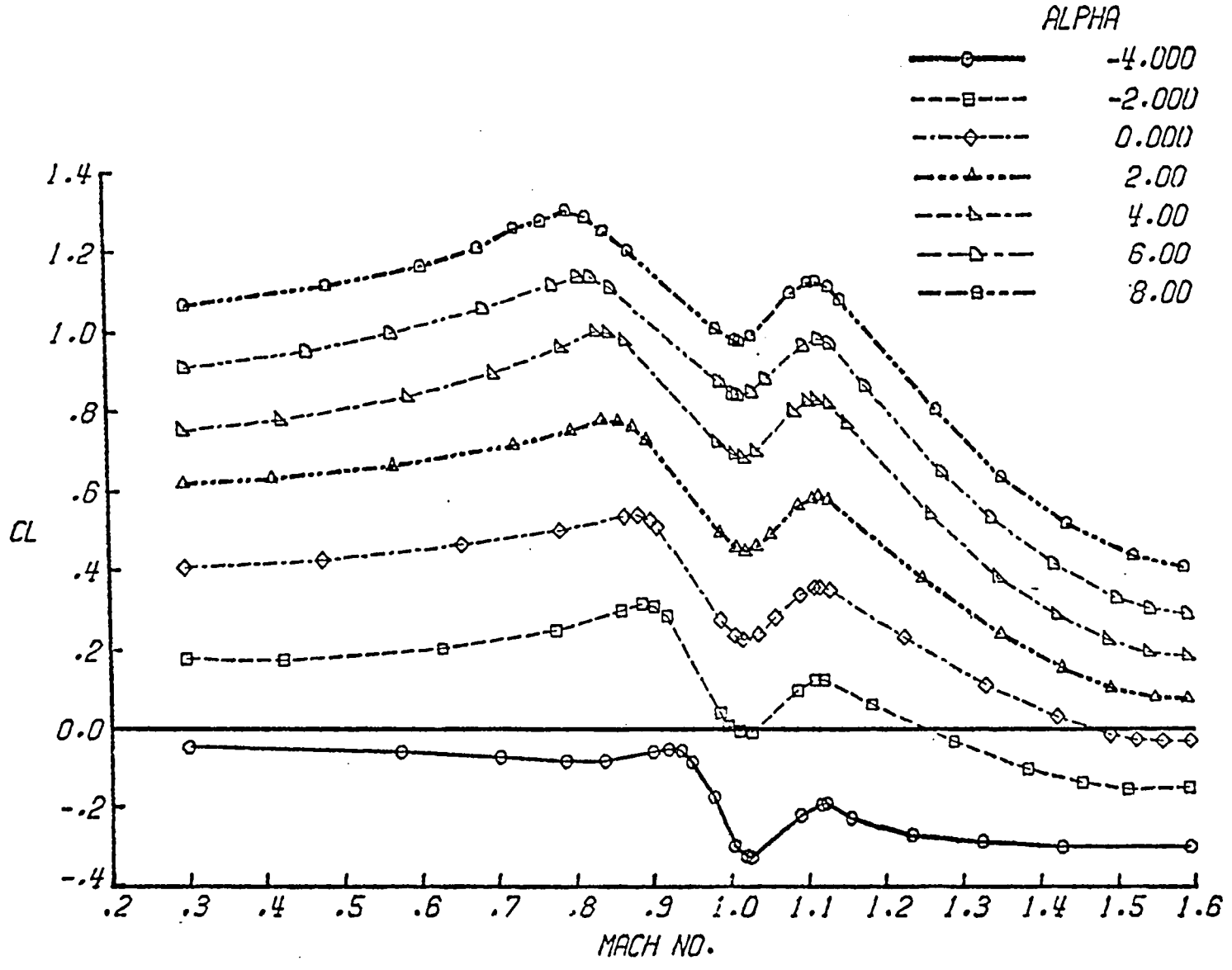

Figure 2.- Data points digitized from lift coefficient graph from reference 1 for 16-504.

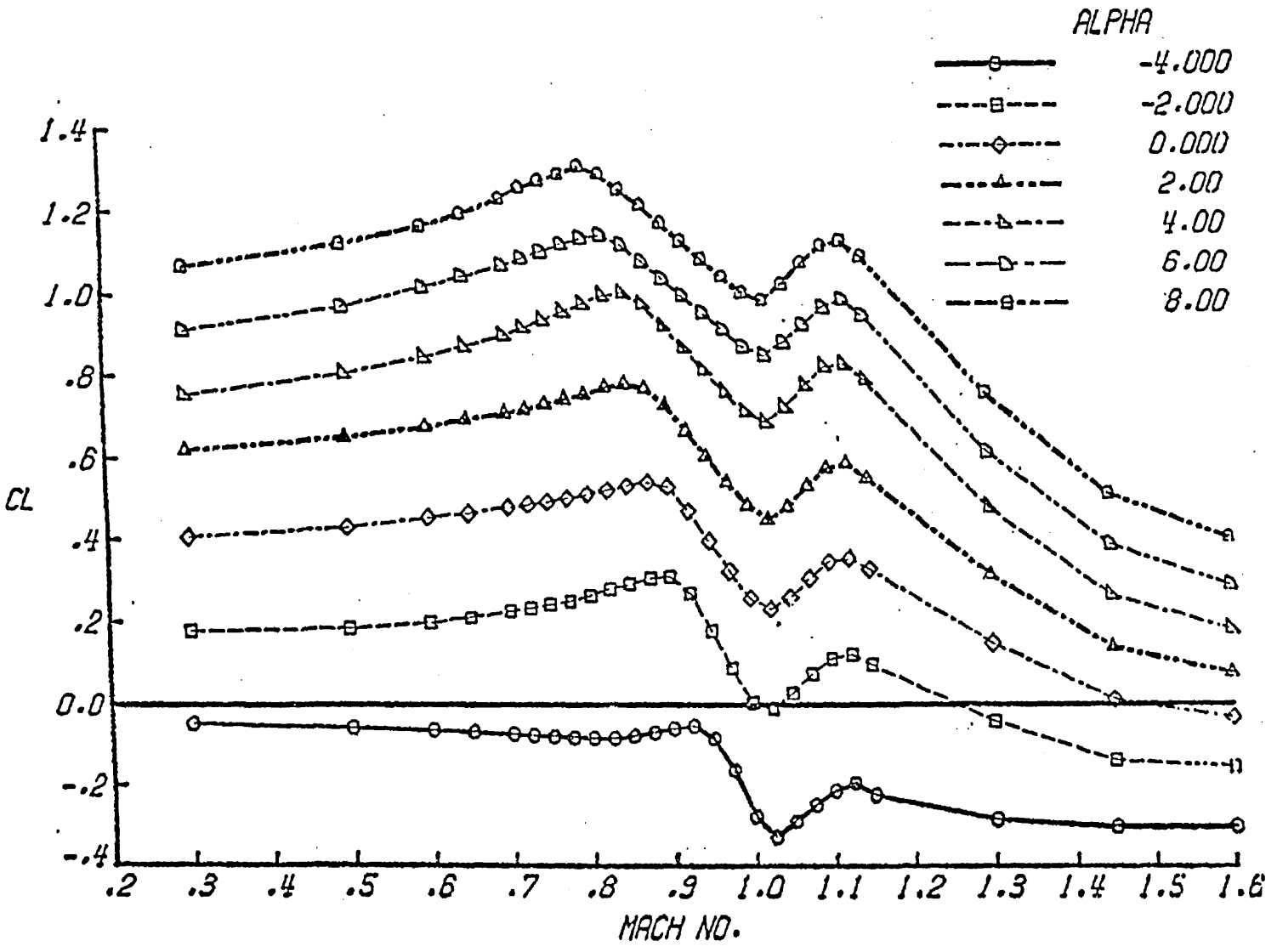

Figure 3.- Data points in lift coefficient table for 16-504, revised program.

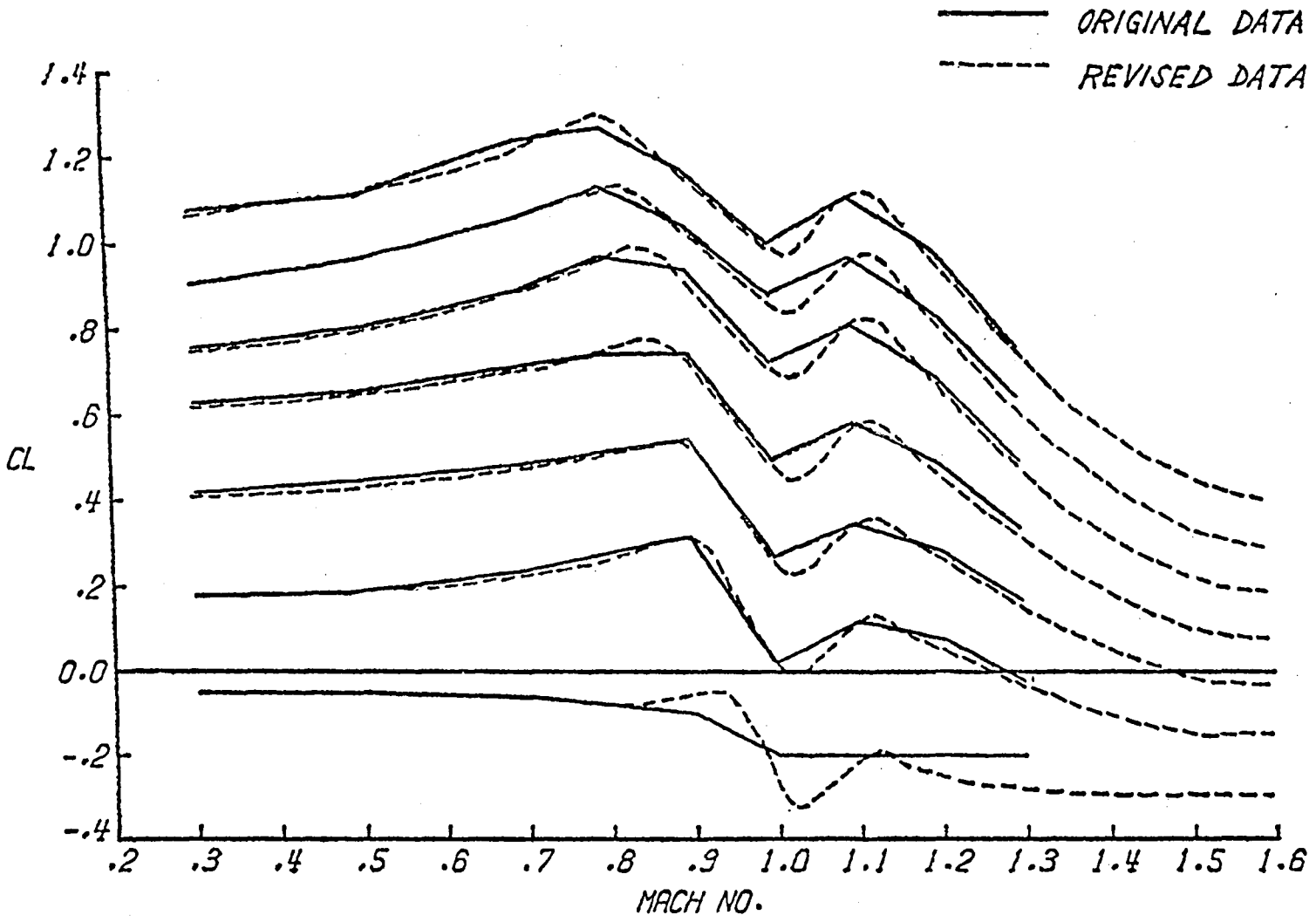

Figure 4.- Comparison of data declarations in original and revised programs.

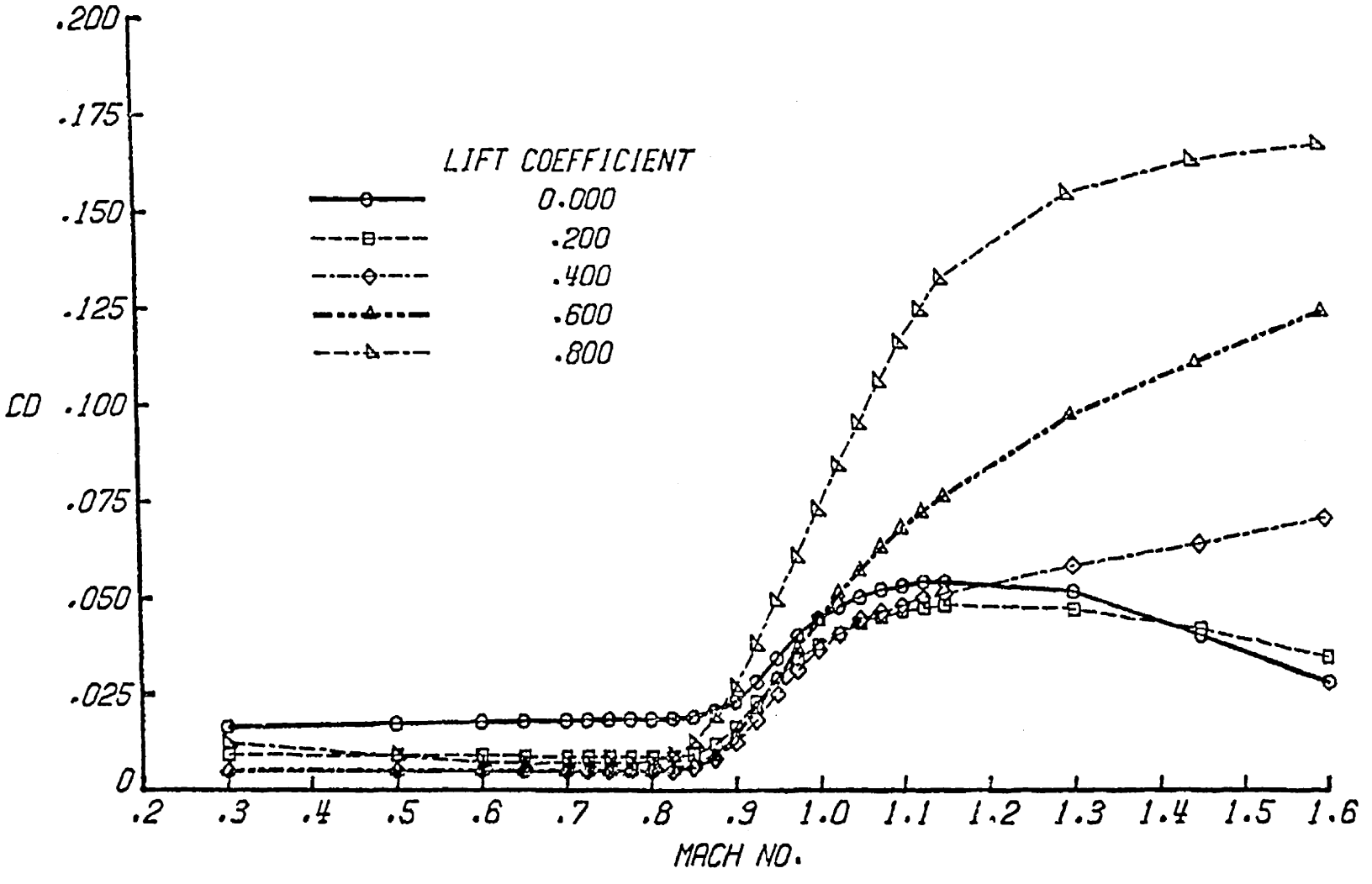

Figure 5.- Data points in drag coefficient table for 16-504, revised program.

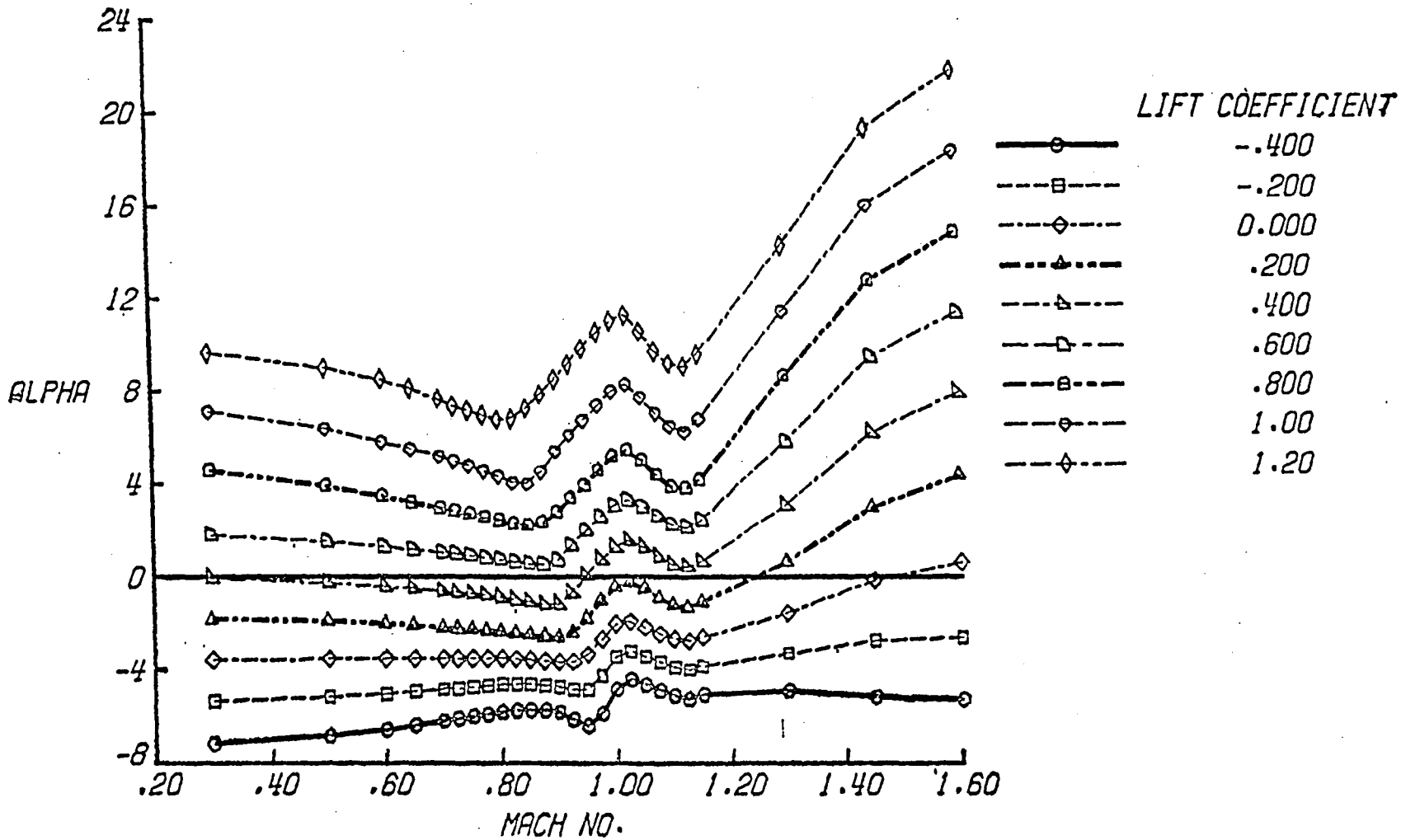

Figure 6.- Data points in angle of attack table for 16-504, revised program.

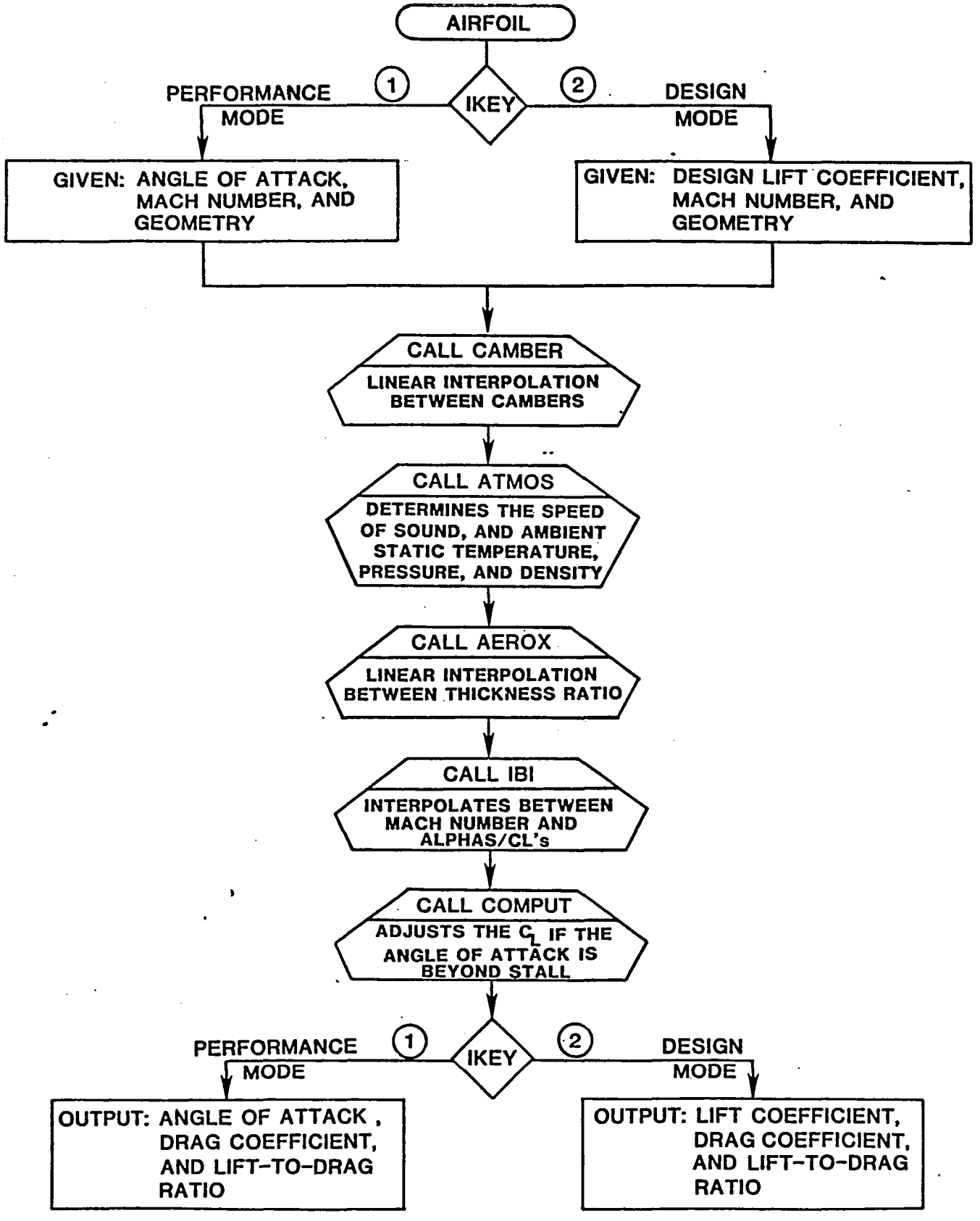

Figure 7. - Program Flowchart

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15. Supplementary Notes

16. Abstract

A comprehensive and easily accessible data bank on the aerodynamic characteristics of 16-series sections was needed to facilitate the studies performed. A computer program was written to provide the needed data base over a large range of cambers, thicknesses, angles of attack, and Mach numbers. This paper discusses the uses and limitations of the program. Some studies were done to evaluate the program in the range for which data were available. The program was compared with graphs from which the program's data were derived and also to sources of wind-tunnel data.

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