"HARPO: A versatile three-dimensional Hamiltonian ray-tracing program for acoustic waves in an Ocean with Irregular Bottom", by R. Michael Jones, J. P. Riley, and T. M. Georges
NOAA special report, October 1986

Errata, July 3, 2014

page 47, line 7: Add "with a copy of the input data file" after "raysets".

page 49, Fig. 2.24: The implied decimal point for latitude of transmitter should be between card columns 16 and 17. The implied decimal point for longitude of transmitter should be between card columns 22 and 23. The implied decimal point for imaginary part of wave polarization at transmitter should be between card columns 75 and 76. (20 April 2007)

page 50, Fig. 2.25: The imaginary part of wave polarization should be in card columns 74-77, and the implied decimal point should be between card columns 75 and 76. (20 April 2007)

page 158, Table 7.25: Change "XMIN0,YB" to "YMIN0,YB"

page 158, Table 7.25: Change "XMAX0,YT" to "YMAX0,YT"

page 214: The sentence "Superimpose these raypath plots on the graph of the previous runset:" should read "Superimpose these raypath plots on the graph of the next runset:"

page 223, 6th line from bottom should read:
      the fractional increase of C with depth, $\epsilon_1 = $ _____(W158)

page 223, last line should read:
      the fractional increase of C with depth, $\epsilon_2 = $ _____(W163)

page 223: The formula for η should contain a minus sign.

page 224, 6th line from bottom should read:
      the fractional increase of C with depth, $\epsilon_1 = $ _____(W158)

page 224, last line should read:
      the fractional increase of C with depth, $\epsilon_2 = $ _____(W163)

page 224: The formulas for η_1 and η_2 should contain minus signs.

1

page 225: Change "W200" to "W150", "W201" to "W151", and "W202" to "W152".

page 235: Change the model check number for subroutine RBOTM to "2.0".

page 236: Change the model check number for subroutine RVERT to "3.0".

page 240: 9th line from the bottom, change "HARPA" to "HARPO".

page 248: After line RAQC1670 of PROGRAM RAYTRC, insert

        LHDRPG = LINES/LINSPP*LINSPP   RAQC1675

page 261: line REXW0290 in FUNCTION READW should read:

        PARAMETER (MXCMTS=83,BIGVAL=1.E9)   REXW0290

page 261: line REXW0360 in FUNCTION READW should read:

        LOGICAL NWOK,AB,UCON,UUCON,SETUCON   REXW0360

page 264: line REXW1980 in FUNCTION READW should read:

        UUCON=SETUCON(X.Y,Z)   REXW1980

page 271: line TRWE0730 in SUBROUTINE TRACE should read:

        IF(THERE.AND.FDOT.EQ.0.) RSIGN = SIGN(1.0,D2Z)   TRWE0730

page 273: In line TRWE1870 of SUBROUTINE TRACE, change SSURF TO ASURF.

page 295: Line COPK0610 in SUBROUTINE CONBLK should read:
        DATA CUEF/1.d0,8.31436d-3,1.4d0/   COPK0610

page 311: line OCBD1370 in SUBROUTINE OCNHD should read:

1000 FORMAT(A1/A80,21X,2A10,' PAGE',I4)   OCBD1370

page 311: in line OCBD1540 in SUBROUTINE OCNHD, change "F12.6" to "F18.6".

page 330: Change lines LAOT0750 and LAOT0760 to
C LOOP FOR 9 MODELS AND PERTURBATIONS
        DO 1700 K=1,18

         Insert the following 4 lines after line LAOT0880
        IF(I.EQ.7) WRITE(LABEL,1600) (MODT(J),J=J1,J2)

```
      IF(I.EQ.8 .AND. J1.EQ.1)
    1 WRITE(LABEL,1600) (MODM(J),J=J1,J2)
      IF(I.EQ.9) WRITE(LABEL,1600) (MODP(J),J=J1,J2)
```

page 335: Replace lines DRYS014 through DRYS019 in SUBROUTINE DRAWTKS with

```
      IF(DTICV.GT.0.) THEN
       YBP=YMID-AINT((YMID-YB)/DTICV)*DTICY
       NTICX=(XR-XL)/DTICH+1.5
      ELSE
       YBP=YB
       NTICX=2
      ENDIF
C
      nticy=2
      IF(DTICV.GT.0.d0) NTICY=(YT-YBP+DTICV)/DTICV+0.5 ! added .5
```

page 337: Change line PLGB0360 in SUBROUTINE PLTLB to
```
      WRITE(ANNOT,50)
    & IDINT((V-EARTHR)*F*dsign(1.d0,hb) +
    & dsign(.5, (V-EARTHR)*F*dsign(1.d0,hb) ))
```

page 337: Change line PLGB0400 in SUBROUTINE PLTLB to
```
   60 WRITE(ANNOT,80) SNGL((V-EARTHR)*F*dsign(1.d0,hb))
```

page 338: Change lines ARPC0100 and ARPC0110 in SUBROUTINE ARCTIC to

```
      IF(TIC.NE.0.) NTIC=1.5+(THMAX-THMIN)/TIC              ARPC0100
      NLINE=MAX0(3,100/NTIC)                                ARPC0110
```

page 364: Line WGZ20140 in SUBROUTINE WGAUSS2 should be

```
      DATA RECOGU/8.0/                                      WGZ20140
```

page 381: Change line CSS10140 in SUBROUTINE CSMUNK1 to

```
C        ETA = -2(Z-ZA)/H                                   CSS10140
```

page 384: Change line CSS20140 in SUBROUTINE CSMUNK2 to

```
C        ETA = -2(Z-ZA)/H                                   CSS20140
```

page 389: (SUBROUTINE CTABLE)

```
      Line CTUE0180, change CMX to CPX.
      Line CTUE0190, change CNTBL to CQTBL.
```

Line CTUE0200, change CITBL to CLTBL.
Line CTUE0210, change CFRMTBL to CIRMTBL.

After line CTUE0210:

Insert a copy of line CSS10370 through CSS10460 (from SUBROUTINE CSMUNK1) on page 383.

page 393: In lines CB2 0020 and CB2 0050 in SUBROUTINE NPSPEED, change B2 to B4.

page 415: Change lines GTLH0490 and GLTH0500 in SUBROUTINE GTANH to comments.

page 428: Change line RVRT0190 in SUBROUTINE RVERT to

      DATA RECORR/3.0/   RVRT0190

page 429: SUBROUTINE GAMANG should be inserted before SUBROUTINE SMPANN in the middle of page 429. This is a subroutine to calculate the side of a spherical triangle by law of cosines.

```
       SUBROUTINE GAMANG(THA,PHA)                                      GAMANG 2
C      COMMON DECK "GAMANG" INSERTED HERE                              CGAMANG2
       COMMON/SPHGAM/SINLM0,COSLM0,GPH0,COSPHD,SINTH,COSTH             CGAMANG4
       COMMON/SPHGAM/GAMFUN,PGMTH,PGMPH,PGMTHTH,PGMPHPH,PGMTHPH        CGAMANG5
C                                                                      GAMANG 4
       COSPHD=dCOS(PHA-GPH0)                                           GAMANG 5
       SINTH=dSIN(THA)                                                 GAMANG 6
       COSTH=dCOS(THA)                                                 GAMANG 7
C                                                                      GAMANG 8
       GAMFUN=SINLM0*COSTH+COSLM0*SINTH*COSPHD                         GAMANG 9
C                                                                      GAMANG10
       PGMTH=-SINLM0*SINTH+COSLM0*COSTH*COSPHD                         GAMANG11
C                                                                      GAMANG12
       PGMPH=-COSLM0*SINTH*dSIN(PHA-GPH0)                              GAMANG13
C                                                                      GAMANG14
       PGMTHTH=-(SINLM0*COSTH+COSLM0*SINTH*COSPHD)                     GAMANG15
C                                                                      GAMANG16
       PGMPHPH=-COSLM0*SINTH*COSPHD                                    GAMANG17
C                                                                      GAMANG18
       PGMTHPH=-COSLM0*COSTH*dSIN(PHA-GPH0)                            GAMANG19
C                                                                      GAMANG20
       RETURN                                                          GAMANG21
       END                                                             GAMANG22
```