```
1 REM ***********************************************
2 REM >> OBS << - STI-30-U  COPYRIGHT (C) 1979 SAT TRAK
3 REM BY    WILLIAM N BARKER   AND  DAVID G COOKE
4 REM            ALL RIGHTS RESERVED     10 FEB 80
5 REM ***********************************************
10 CLEAR 4000
20 CLS:PRINT CHR$(23):PRINT@280,"OBS ELEMENT UPDATE"
22 PRINT@344,"COPYRIGHT (C) 1979"
24 PRINT@408,"SAT TRAK INT'L"
30 DIM N$(9)
240 DIM TLC(9,3):DIM DB(9,13)
245 DIM J$(1),K$(1),Q$(1)
250 DATA 77,1.737371,4.879062,-.05227522
260 DATA 78,1.733205,4.874896,-.05674153
270 DATA 79,1.729039,4.870730,-.061208
280 DATA 80,1.724872,4.866563,-.0656743
290 DATA 81,1.737908,4.879601,-.05293787
300 DATA 82,1.733742,4.875434,-.05740420
310 DATA 83,1.729576,4.871268,-.06187052
320 DATA 84,1.725409,4.867101,-.06633684
330 DATA 85,1.738446,4.880138,-.05360119
340 DATA 86,1.734279,4.875971,-.05806752
350 FORI=0TO9:FORJ=0TO3:READTL(I,J):NEXTJ:NEXTI
360 OPEN"I",1,"WKFILE"
365 FOR I=0TO9
366 PRINT@450,"*** INPUT SATELLITE DATA ***"
370 INPUT#1,N$(I)
375 FOR J=0 TO 13
380 INPUT#1,DB(I,J)
384 NEXT J
385 DB(I,0)=I+1
386 PRINT@450,"                                    "
390 NEXT I
400 CLOSE
570 CR=57.29578:R9=1.570796:ER=6378.145
580 FF=3.352892E-3:E2=6.694542E-3:PI=3.1415926
590 RP=1.7453292E-2:QJ2=8.119117E-4:MJ2=-1.623823E-3
600 KE=1.070882E2:RR=6.283185:CV=7.905368
610 S0=.17365:TD=5.883366E-2
620 C6=4.778819E-8:ME=.9933055
630 C2=3.34462E-2:C4=4.50104E-2:C5=.4336428
640 TM=3.472222E-3
650 CLS:PRINT:PRINT:PRINT"ENTER OBSERVATION SITE COORDINATES AS-"
655 PRINT"LATITUDE    LONGITUDE    ALTITUDE"
660 PRINT"N/S,DEGREES,E/W,DEGREES,FEET ABOVE MSL (USE COMMAS)"
662 J$="":K$=""
665 INPUT J$,GL,K$,LN,S8:P1=GL:P2=LN
680 IF J$="N" THEN 700
685 IF J$="S" THEN 710
690 PRINT">>> ERROR ON INPUT <<<":GOTO 665
700 GL=GL/CR:GOTO 720
710 GL=-(GL/CR)
720 IF K$="E" THEN 740
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730 IF K$="W" THEN 750
735 GOTO 690
740 LN=LN/CR:GOTO 850
750 LN=(360-LN)/CR
850 ST=SIN(GL):COT=COS(GL)
860 S8=S8*C6:S1=1/SQR(1-(E2*ST[2)):S2=S1*ME
870 S3=(S1+S8)*COT:SX=S3*COS(LN):SY=S3*SIN(LN)
880 SZ=(S2+S8)*ST:R=SQR(SX[2+SY[2+SZ[2)
890 R1=S3:SP0=SZ/R:CP0=R1/R:TP=ATN(SZ/R1):AB=ABS(TP)
900 PRINT:PRINT
910 PRINT"********************** SATELLITE DATA BASE **********************"
920 PRINT" #  OBJ #  NAME          PERIOD   INCLIN";
930 PRINT"-  ELSET# REV #  EPOCH"
940 FORI=0TO9
970 PRINTDB(I,0);TAB(3)DB(I,1);TAB(11)N$(I);TAB(22)24/DB(I,12)*60;
980 PRINTTAB(31)DB(I,7);
990 PRINTTAB(40)DB(I,6);TAB(47)DB(I,13);TAB(54)DB(I,3)+DB(I,4)
1010 NEXT I
1020 FOR I=1 TO 64: PRINT"*";: NEXT I
1030 INPUT"SELECT SATELLITE";S
1040 IF (S<1 OR S>10) THEN 1030
1060 S=S-1:YY=DB(S,2):DD=DB(S,3):FD=DB(S,4):M0=DB(S,11)*RP
1070 RI=DB(S,8)*RP:AP=DB(S,10)*RP:E0=DB(S,9):I0=DB(S,7)*RP
1080 N0=DB(S,12)*RR:ND0=DB(S,5)*RR
1090 FOR I=0TO9:IFTL(I,0)=YYTHEN 1110
1100 NEXTI:PRINT:PRINT">>>EPOCH YEAR";YY;"NOT IN ALMANAC<<<":GOTO 910
1110 IF(YY=86 AND DD>305)THEN PRINT"***NOTICE***"
1120 IF(YY=86 AND DD>305)THEN PRINT"ALMANAC UPDATE REQUIRED IN <60 DAYS"
1130 T1=TLC(I,1):SN=TLC(I,2):MO=TLC(I,3)
1140 A=(T1+DD*1.720279E-2+FD*6.300388)
1150 Z=A:A=A/RR:X=A(ABS(A))*INT(ABS(A)):T2=Z-X*RR
1160 IY=YY:MY=YY-1:YF=0:DI=365:LY=48
1170 FORJ=1 TO 12:LY=LY+4
1180 IF MY=LY THEN YF=1
1190 IF IY=LY THEN 1220
1200 NEXT J
1210 GOTO 1230
1220 DI=366
1230 A0=(KE/N0)[.6666667:Q2=A0*(1-E0)
1240 HI=0:CH=1:SM=0:I1=I0
1250 IF I0>R9THEN I1=PI-I0
1260 IF I1>=ABTHEN 1310
1270 D=CH/COS(HI+AB-I1):IF D<Q2THEN 1310
1280 PRINT">>>SATELLITE NEVER VISIBLE FROM INPUT LATITUDE";
1290 PRINT"→";GL*CR;"<<<"
1300 FOR I=0TO250:NEXT I:GOTO 910
1310 CLS:PRINT"SATELLITE  ";N$(S)
1320 PRINT:PRINT"ENTER OBSERVED CULMINATION TIME AS-"
1330 PRINT"YY,DDD,HH,MM,SS        USE COMMAS"
1340 INPUTY8,D8,H8,M8,S9
1370 IF(Y8<>0 AND D8<>0)THEN 1390
1380 PRINT:PRINT">>>ERROR ON INPUT<<<":GOTO 1310
1390 Y1=Y8:D1=D8:H1=H8+(M8/60)+(S9/3600)
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1400 FORI=1TO64:PRINT"-";:NEXT
1410 PRINT" OBSERVATION SITE ";J$;P1;K$;P2;
1420 PRINT" ALT";S8/C6;"FT MSL"
1430 FORI=1TO64:PRINT"-";:NEXT
1440 PRINT"CORRECTION FOR ";N$(S);DB(S,1);TAB(35)"EPOCH DAY";
1450 PRINTDD;TAB(49)"AT";TAB(51)FD*24;TAB(60)"HRS"
1460 PRINTTAB(35)"NEW EPOCH";D1;TAB(49)"AT";TAB(51)H1;TAB(60)"HRS"
1470 PRINT"PERIOD";24/DB(S,12)*60;"MIN.";
1480 PRINTTAB(35)"INCLINATION";I0*CR;"DEG."
1490 FORI=1TO64:PRINT"-";:NEXT
1500 IF YY=Y1THEN 1540
1510 IF YY>Y1THEN 1530
1520 DA=D1-DD+DI:GOTO 1550
1530 DA=D1-DD-365-YF:GOTO 1550
1540 DA=D1-DD
1550 HA=(H1/24)-FD:HA=HA+DA
1560 T1=HA-.02083333:TF=HA+.02083333
1570 FS=0:T=T1-TM
1580 FBDT=1
1590 T=T+TM
1600 GOSUB 2480
1610 IF T>=TF THEN 1630
1620 GOTO 1640
1630 PRINT:PRINT">>> CULMINATION NOT FOUND <<<":PRINT:GOTO 2470
1640 GOSUB 2760
1650 XFDT=FBDT
1660 GOSUB 2880
1662 IF RS<1.5 THEN 1670
1664 PRINT:PRINT">>>CULMINATION NOT WELL DEFINED FOR THIS SAT <<<":PRINT
1666 GOTO4000
1670 GOSUB 2820
1680 IF(XFDT<0 OR FBDT>0 OR RBDZ<0)THEN 1590
1690 TS=T
1700 JJ=0
1710 FORN=1TO5
1720 T=T-6.944445E-4
1730 GOSUB 2480
1740 GOSUB 2880
1750 GOSUB 2760
1760 GOSUB 2820
1770 IF FBDT>0THEN 1840
1780 NEXT N
1790 T=TS+.02777778
1800 FBDT=1:GOTO 1590
1810 GOSUB 2880
1820 GOSUB 2760
1830 GOSUB 2820
1840 IF RBTZ<0THEN 1790
1850 JJ=JJ+1
1860 A4=RS[3
1870 A5X=-(RX/A4)
1880 A6Y=-(RY/A4)
1890 A7Z=-(RZ/A4)
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1900 Z5X=-ZX*3.461399E-3
1910 Z6Y=-ZY*3.461399E-3
1920 F6=A5X*ZX+A6Y*ZY+A7Z*ST
1930 F6=F6+2*(XDT*DX+YDT*DY)+RX*Z5X+RY*Z6Y
1940 T8=FBDT/(F6*KE)
1950 T9=ABS(T8)
1960 IF T9<=6.944445E-4 THEN 1980
1970 TK=T-(T8/T9)*6.944445E-4:GOTO 1990
1980 TK=T-T8
1990 IF T9<=1.157407E-5 THEN 2030
2000 T=TK
2010 GOSUB 2480
2020 IF JJ<=5 THEN 1810
2030 TE=TK:T=HA:GOSUB 2880
2040 YY=Y1:DD=D1:FD=H1/24
2050 N0=NT:E0=ET:T=TE-HA:FS=0
2060 Z=M9:M9=M9/RR:X=(M9/ABS(M9))*INT(ABS(M9)):M0=Z-X*RR
2070 Z=O4:O4=O4/RR:X=(O4/ABS(O4))*INT(ABS(O4)):AP=Z-X*RR
2080 Z=RA:RA=RA/RR:X=(RA/ABS(RA))*INT(ABS(RA)):RI=Z-X*RR
2090 GOSUB 2880
2100 N0=NT/RR:E0=ET
2110 Z=M9:M9=M9/RR:X=(M9/ABS(M9))*INT(ABS(M9)):M0=Z-X*RR
2120 Z=O4:O4=O4/RR:X=(O4/ABS(O4))*INT(ABS(O4)):AP=Z-X*RR
2130 Z=RA:RA=RA/RR:X=(RA/ABS(RA))*INT(ABS(RA)):RI=Z-X*RR
2132 IF M0<0 THEN M0=M0+RR
2134 IF AP<0 THEN AP=AP+RR
2136 IF RI<0 THEN RI=RI+RR
2138 M0=M0*CR: AP=AP*CR: RI=RI*CR
2140 RE=DB(S,13)
2150 IF HA<>0THEN RE=RE+(N0*HA/ABS(N0*HA))*INT(ABS(N0*HA))
2160 PRINT"PARAMETER NAME";TAB(20)"NASA ELS";TAB(29)"OLD EPOCH";
2170 PRINTTAB(42)"UNITS";TAB(53)"NEW EPOCH"
2180 PRINT"DATA BASE NUMBER";TAB(22)"-";TAB(29)DB(S,0);
2190 PRINTTAB(44)"-";TAB(53)DB(S,0)
2200 PRINT"SATELLITE NUMBER";TAB(20)"SATNO";TAB(29)DB(S,1);
2210 PRINTTAB(44)"-";TAB(53)DB(S,1)
2220 PRINT"EPOCH YEAR";TAB(20)"EPYR";TAB(29)DB(S,2);
2230 PRINTTAB(42)"YEARS";TAB(53)YY
2240 PRINT"EPOCH DAY";TAB(20)"EPOCH";TAB(29);DB(S,3);
2250 PRINTTAB(42)"DAYS";TAB(53)DD
2260 PRINT"EPOCH FRACTION DAY";TAB(20)"EPOCH";TAB(29)DB(S,4);
2270 PRINTTAB(42)"DEC.DAY";TAB(53)FD
2280 PRINT"PERIOD DECAY RATE";TAB(20)"NDOT2";TAB(29)DB(S,5);
2290 PRINTTAB(42)"(R/D)↑2";TAB(50)DB(S,5)
2300 PRINT"ELSET NUMBER";TAB(20)"ELNO";TAB(29)DB(S,6);
2310 PRINTTAB(44)"-";TAB(53)DB(S,6)+10000
2320 PRINT"INCLINATION";TAB(20)"II";TAB(29)DB(S,7);
2330 PRINTTAB(42)"DEGREES";TAB(53)DB(S,7)
2340 PRINT"RIGHT ASCENSION";TAB(20)"NODE";TAB(29)DB(S,8);
2350 PRINTTAB(42)"DEGREES";TAB(53)RI
2360 PRINT"ECCENTRICITY";TAB(20)"EE";TAB(29)DB(S,9);
2370 PRINTTAB(44)"-";TAB(50)E0
2380 PRINT"ARGUMENT OF PERI.";TAB(20)"OMEGA";TAB(29)DB(S,10);
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2390 PRINTTAB(42)"DEGREES";TAB(53)AP
2400 PRINT"MEAN ANOMALLY";TAB(20)"MM";TAB(29)DB(S,11);
2410 PRINTTAB(42)"DEGREES";TAB(53)M0
2420 PRINT"MEAN MOTION";TAB(20)"NN";TAB(29)DB(S,12);
2430 PRINTTAB(42)"REVS/DAY";TAB(53)N0
2440 PRINT"REV NUMBER";TAB(20)"REVNO";TAB(29)DB(S,13);
2450 PRINTTAB(42)"REVS";TAB(53)RE
2460 INPUT"COPY NEW ELEMENTS FOR INPUT TO PROGRAM <UPDATE>";D
2470 GOTO 4000
2480 IF ABS(T)<1E-6 THEN 2510
2490 IT=(T/ABS(T))*INT(ABS(T)):FT=T-IT
2500 RETURN
2510 IT=0:FT=0
2520 RETURN
2530 ID=DD+IT:FX=FD+FT
2540 IF ABS(FX)<1E-6 THEN FX=0
2550 IF ABS(FX)<1 THEN 2570
2560 HR=(FX/ABS(FX))*INT(ABS(FX)):ID=ID+HR:FX=FX-HR
2570 IF FX>=0THEN 2590
2580 FX=FX+1:ID=ID-1
2590 HR=FX*24:IH=INT(HR):MI=(HR-IH)*60:IM=INT(MI)
2600 SD=(MI-IM)*60:IS=INT(SD):FR=SD-IS
2610 IF FR>=.5 THEN IS=IS+1
2620 IFABS(IS-60)<.5 THEN 2640
2630 IF IS<60 THEN 2650
2640 IS=0:IM=IM+1
2650 IF IM<60 THEN 2670
2660 IM=0:IH=IH+1
2670 IF IH<24 THEN 2690
2680 IH=0:ID=ID+1
2690 IF ID>0 THEN 2720
2700 ID=ID+365+YF:YI=IY-1
2710 RETURN
2720 IF ID>DI THEN 2740
2730 YI=IY:GOTO 2750
2740 ID=ID-DI:YI=IY+1
2750 RETURN
2760 TG=T2G0+IT*1.720218E-2+FT*6.300387
2770 Z=TG:TG=TG/RR:X=(TG/ABS(TG))*INT(ABS(TG)):TG=Z-X*RR
2780 A=TG+LN:Z=A:A=A/RR:X=A(ABS(A))*INT(ABS(A)):AF=Z-X*RR
2790 SIA=SIN(AF): C9A=COS(AF)
2800 X2S=R1*C9A:Y2S=R1*SIA:Z2S=SZ
2810 RETURN
2820 ZX=COT*C9A:ZY=COT*SIA:DX=-ZY*TD:DY=ZX*TD
2830 ROX=RX-X2S:R2Y=RY-Y2S:R3Z=RZ-Z2S
2840 RHO=SQR(ROX[2+R2Y[2+R3Z[2)
2850 RBDTZ=RX*ZX+RY*ZY+RZ*ST
2860 FBDT=XDT*ZX+YDT*ZY+ZDT*ST+RX*DX+RY*DY
2870 RETURN
2880 IF FST=1 GOTO 3000
2890 FS=1:A0=(KE/N0)[.6666667:DP=(COS(I0))[2
2900 IF E0=0 THEN E0=1E-6
2910 DE=(QJ2/A0[2)*(3*DP-1)/(1-E0[2)[1.5
2920 A0=A0*(1-.3333333*DE-DE[2-1.654321*DE[3)
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2930 P0=A0*(1-E0[2):CCI=COS(I0):SCI=SIN(I0):Q0=A0*(1-E0)
2940 IF I0<=R9 GOTO 2960
2950 L0=M0+AP-RI:GOTO 2970
2960 L0=M0+AP+RI
2970 RD=(MJ2/P0[2)*N0*CCI:OD=(QJ2/P0[2)*N0*(5*DP-1)
2980 A2=E0*COS(AP):A3=E0*SIN(AP):AC=ABS(CC)
2990 DP=-(MJ2/P0[2)*(2-2.5*(SIN(I0)[2)-ACCI)
3000 NT=N0+2*(ND*T):AI=A0*(N0/NT)[.6666667
3010 IF AI>Q0 THEN 3030
3020 ET=1E-6:GOTO 3040
3030 ET=1-Q0/AI
3040 PT=AI*(1-ET[2):RA=RI+RD*T:SA=SIN(RA):CA=COS(RA)
3050 DW=OD*T:SW=SIN(DW):CW=COS(DW)
3060 O4=AP+DW:M9=M0+N0*T+ND*(T[2)
3070 AX=(ET/E0)*(A2*CW-A3*SW)
3080 AY=(ET/E0)*(A2*SW+A3*CW)+(1.124660E-3*SCI/P0)
3090 XM=-SA*CC:YM=CA*CC:ZM=SC:XN=CA:YN=SA
3100 L3=(.5623302E-3/P0)*AXN*SCI*(3+5*ACCI)/(1+ACCI)
3110 XL=L0+N0*(1+DP)*T+L3+ND0*T[2
3120 IF I0<=R9 GOTO 3140
3130 U=XL+RA:GOTO 3150
3140 U=XL-RA
3150 K=0:EW=U:DF=1E9
3160 FOR J=1TO10
3170 EP=U+AXN*SIN(EW)-AYN*COS(EW)
3180 A1=ABS(EP-EW)
3190 IF A1<=1.0E-6 GOTO 3270
3200 IF A1>DF GOTO 3220
3210 DF=A1:HOLD=EP
3220 DL=(EP-EW)/(1-AXN*COS(EW)-AYN*SIN(EW))
3230 D=ABS(DL):IF D<1THEN 3250
3240 DL=DL/D
3250 EW=EW+DL:NEXT J
3260 K=1:EP=HO
3270 EW=EP:CEW=COS(EW):SEW=SIN(EW):EC=AX*CE+AY*SE
3280 ES=AX*SE-AY*CE:RS=AI*(1-EC):AA=ES/(1+SQR(1-ET[2))
3290 CU=AI/RS:SU=CU*(SE-AY-AX*AA)
3300 CU=CU*(CE-AX+AY*AA)
3310 UX=XN*CU+XM*SU:UY=YN*CU+YM*SU:UZ=ZM*SU
3320 RX=RS*UX:RY=RS*UY:RZ=RS*UZ
3330 VE=SQR(AI)*ES/RS:VX=-XN*SU+XM*CU:VY=-YN*SU+YM*CU
3340 VZ=ZM*CU:RV=SQR(PT)/RS:XD=VE*UX+RV*VX
3414 YD=VE*UY+RV*VY:ZD=VE*UZ+RV*VZ
3360 RETURN
4000 CLS:PRINT"1. NEW SATELLITE"
4005 PRINT"2. NEW OBSERVATION  SITE"
4006 PRINT"3. RETURN TO CONTROL"
4007 PRINT
4010 PRINT:INPUT"SELECT OPTION 1 2 OR 3";D
4020 ON D GOTO 910,850,4050
4050 RUN"CONTROL"
4100 END
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