```
L       TVCSTROKETEST                                          USER'S PAGE NO.  1      E0 S3

R1000   NAME      STROKE TEST PACKAGE   (INCLUDING INITIALIZATION PACKAGE)
R1001   ORIGINAL CODING BY OLSSON        LOG SECTION....STROKE TEST PACKAGE
R1002   MOD BY ENGEL                    DATE....21 MARCH, 1967

R1003   FUNCTIONAL DESCRIPTION....
R1004        STROKE TEST PACKAGE GENERATES A WAVEFORM DESIGNED TO EXCITE BENDING
R1005        STRKTSTI (STROKE TEST INITIALIZATION) IS CALLED AS A JOB BY V88.
R1006                 IT INITIALIZES ALL ERASABLES REQD FOR A STROKE TEST, AND
R1007                 THEN TESTS FOR AN 80MS DAP. IF 80MS IT SETS STROKER = ESTROKER
R1009                 FOR AN IMMEDIATE STROKE TEST, OTHERWISE IT MERELY ENABLES
R1010                 A STROKE TEST BY SETTING STROKER TO -0. THE STROKE TEST
R1011                 THEN AWAITS SWITCHOVER TO THE 80MS DAP WHEREUPON IT IS
R1012                 ENABLED AFTER AN ADDITIONAL 4 SECOND DELAY TO AVOID
R1013                 THE SWITCHOVER TRANSIENTS (SEE STRKCALL, STRKUP IN
R1014                 TVCEXECUTIVE)
R1015        HACK (STROKE TEST) GENERATES THE WAVEFORM BY DUMPING PULSE BURSTS
R1016                 OF PROPER SIGN AND IN PROPER SEQUENCE DIRECTLY INTO
R1017                 TVCPITCH, WORKING IN CONJUNCTION WITH BOTH PITCH AND YAW
R1018                 TVC DAPS, WITH INTERMEDIATE WAITLIST CALLS. NOTE, HOWEVER
R1019                 THAT THE STROKE TEST IS PERFORMED ONLY IN THE PITCH AXIS.
R1020                 AN EXAMPLE WAVEFORM IS GIVEN BELOW, TO DEMONSTRATE STROKE-
R1021                 TEST PARAMETER SELECTION
R1022        RESTARTS CAUSE TEST TO BE TERMINATED. ANOTHER V68 REQD IF TEST
R1023                 IS TO BE RE-RUN.
R1027        PULSE BURST SIZE IS PAD-LOADED (ESTROKER) SO THAT AMPLITUDE OF
R1028                 WAVEFORM CAN BE CHANGED.  THERE ARE TEN PULSE BURSTS IN
R1029                 THE HALF-AMPLITUDE OF THE FIRST FREQUENCY SET IN THE
R1030                 STANDARD WAVEFORM.  AMPLITUDE IS 10(ESTROKER)(1/42.15),
R1031                 NOMINALLY 50/42.15  =  1.185 DEG
R1032   CALLING SEQUENCE....
R1033        EXTENDED VERB 68 SETS UP STRKTSTI JOB
R1034        PITCH AND YAW TVCDAPS, FINDING STROKER NON-ZERO, DO A  ..TC HACK..
R1035        AN INTERNALLY-GENERATED WAITLIST CALL ENTERS AT  ..HACKWLST..
R1036   NORMAL EXIT MODES....
R1037        TC BUNKER  (..Q.. IF ENTRY FROM DAP, ..TCTSKOVR.. IF FROM WAITLIST)LIST
R1039   SUBROUTINES CALLED....
R1040        WAITLIST
R1041   ALARM OR ABORT EXIT MODES....
R1042        NONE
R1043   ERASABLE INITIALIZATION REQUIRED....
R1044        ESTROKER (PAD-LOAD)
R1045        STROKER,  CADDY,  REVS,  CARD,  N
R1046   OUTPUT....
R1047        STRKTSTI...INITIALIZATION FOR STROKE TEST
R1048        HACK, HACKWLST...PULSE BURSTS INTO TVCPITCH VIA..ADS..
R1049                         RESETS STROKER = +0 WHEN TEST COMPLETED
R1050   DEBRIS....
R1051        N = CADDY = +0,  CARD = -0,  REVS = -1
R1052        BUNKER
R1053
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P1054   EXAMPLE STROKE TEST WAVE FORM, DEMONSTRATING PARAMETER SELECTION
R1055   NOTE....THIS IS NOT THE OFFICIAL WAVEFORM....

R1056           **              **
R1058           **              **
R1060           **              **          EXAMPLE WAVEFORM (EACH * REPRESENTS
R1062          * *             * *               85.41 ARCSEC OF ACTUATOR CMND)
R1064          * *             * *
R1066          * *             * *
R1068         *   *           *   *         **      **      **      **      **
R1070         *   *           *   *         **      **      **      **      **
R1072         *   *           *   *         **      **      **      **      **
R1074        *     *         *     *       * *     * *     * *     * *     * *    ** ** ** ** **
R1076        *     *         *     *       * *     * *     * *     * *     * *    ** ** ** ** **
R1078        *     *         *     *       * *     * *     * *     * *     * *    ** ** ** ** **
R1080      ------------------------------------------------------------------------------------
R1082              *     *         *     *     * *     * *     * *     * *     * *  ** ** ** ** **
R1084              *     *         *     *     * *     * *     * *     * *     * *  ** ** ** ** **
R1086              *     *         *     *     * *     * *     * *     * *     * *  ** ** ** ** **
R1088               *   *           *   *       **      **      **      **      **
R1090               *   *           *   *       **      **      **      **      **
R1092               *   *           *   *       **      **      **      **      **
R1094                * *             * *
R1096                * *             * *
R1098                * *             * *
R1100                 **              **
R1102                 **              **
R1104                 **              **
R1105   FOR THIS (UNOFFICIAL, EXAMPLE) WAVEFORM, THE REQUIRED PARAMETERS ARE AS FOLLOWS....

R1107       PCARD    = +3    (NUMBER OF SETS)
R1108       ESTROKER = +3    (PULSE BURST SIZE, SC.AT 85.41 ARCSEC/BIT)

R1109       SET1..
R1110           PREVS  = +3  (NUMBER REVERSALS MINUS 1)
R1111           PCADDY = +4  (NUMBER OF PULSE BURSTS IN 1/2 AMPLITUDE)
R1112       SET2..
R1113           PCARD1 = +9  (NUMBER REVERSALS MINUS 1)
R1114           PCARD4 = +2  (NUMBER OF PULSE BURSTS IN 1/2 AMPLITUDE)
R1115       SET3..
R1116           PCARD2 = +9  (NUMBER REVERSALS MINUS 1)
R1117           PCARD5 = +1  (NUMBER OF PULSE BURSTS IN 1/2 AMPLITUDE)
R1118       SET4..
R1119           PCARD3 = +0  (NUMBER REVERSALS MINUS 1)
R1120           PCARD6 = +0  (NUMBER OF PULSE BURSTS IN 1/2 AMPLITUDE)
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L       TVCSTROKETEST                                                                   USER∝S PAGE NO.   3      E0 S3

P1121   STROKE TEST INITIALIZATION PACKAGE  (AS A JOB, FROM VERB 68)

 1122                          17,2213                          BANK   17
 1123   REF   2  LAST  922     20,2000                          SETLOC DAPS2
 1124                          20,3446                          BANK

 1125   REF   1                                                 COUNT* $$/STRK
 1126   REF   2  LAST  103     E6,1665                          EBANK= CADDY

 1127   REF   1                20,3446  0 3465 0  STRKTSTI TCR    TSTINIT      STROKE TEST INITIALIZATION PKG  (CALLED
A1128                                                                                  AS A JOB BY VERB68)

 1129                          20,3447  0 0004 0  TVCDTCHK INHINT                STROKE TEST PERMITTED ONLY WITH 80MS DAP
 1130   REF  10  LAST  936     20,3450  31∝635 0            CAE    T5TVCDT            CHECK CURRENT TIMING
 1131   REF 100  LAST  940     20,3451  54 001 1            TS     L
 1132   REF   2  LAST  907     20,3452  3 7677 0            CAF    OCT37774           LOOK FOR 80MS (T5)
 1133                          20,3453  0 0006 1            EXTEND
 1134   REF  10  LAST  184     20,3454  06 001 0            RXOR   LCHAN         +0 IF 80MS
 1135   REF 206  LAST  936     20,3455  10 000 0            CCS    A
 1136                          20,3456  1 3462 0            TCF    +4                 NOT 80MS

 1137   REF   6  LAST  908     20,3457  31∝412 1            CAE    ESTROKER           80MS. OK, SET STROKER FOR TEST
 1138   REF   9  LAST  930     20,3460  55∝614 1            TS     STROKER
 1139                          20,3461  1 3464 0            TCF    +3

 1140   REF 166  LAST  935     20,3462  4 4714 0            CS     ZERO               ENABLE, BUT DO NOT ACTIVATE STROKE
 1141   REF  10  LAST  945     20,3463  55∝614 1            TS     STROKER                  TEST, AWAITING SWITCHOVER
A1142                                                                                    TO MOD0R (MOD80)
 1143   REF 104  LAST  891     20,3464  1 5112 1            TCF    ENDOFJOB
 1144   REF   1                20,3465  4 3475 0  TSTINIT  CS     FCADDY        NORMAL ENTRY FROM STRKTSTI
 1145   REF   3  LAST  945     20,3466  55∝665 1            TS     CADDY
 1146   REF   2  LAST  103     20,3467  55∝666 1            TS     N                  NOTE SGN CHNG FCADDY(+) TO CADDY(-)

 1147   REF   1                20,3470  3 3476 1            CAF    FREVS
 1148   REF   2  LAST  103     20,3471  55∝670 0            TS     REVS

 1149   REF   1                20,3472  4 3477 1            CS     FCARD              NOTE SGN CHNG FCARD(+) TO CARD(-)
 1150   REF   2  LAST  103     20,3473  55∝671 1            TS     CARD

 1151   REF 188  LAST  940     20,3474  0 0002 0            TC     Q             RETURN TO STRKTSTI+1  (OR CHKSTRK+2OR+4)
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P1152   THE OFFICIAL STROKE TEST WAVEFORM (3 JAN, 1967) CONSISTS OF FOUR STROKE SETS, AS FOLLOWS....

R1154         SET 1...10 BURSTS IN 1/2 AMP,   4 REVERSALS
R1155         SET 2... 6 BURSTS IN 1/2 AMP,   6 REVERSALS
R1156         SET 3... 5 BURSTS IN 1/2 AMP,  10 REVERSALS
R1157         SET 4... 4 BURSTS IN 1/2 AMP,  14 REVERSALS
R1158   THE PULSE BURST SIZE (ESTROKER) IS PAD-LOADED (5 BITS AS OF 3JAN,1967)
R1159   THE REMAINING WAVEFORM-GENERATING PARAMETERS ARE AS FOLLOWS....

 1160                        20,3475   00012 1  FCADDY   DEC     10          NO. PULSE BURSTS IN 1/2 AMP, SET1..(+10)
 1161                        20,3476   00003 1  FREVS    DEC      3          NO. REVERSALS MINUS 1, SET1.....(  3)

 1162                        20,3477   00004 0  FCADD    DEC      4          NO. STROKE SETS.................(+ 4)

 1163                        20,3500   00005 1  FCADD1   DEC      5          NO. REVERSALS MINUS 1, SET2.....(  5)

 1164                        20,3501   00011 1  FCADD2   DEC      9                                        3.....(  9)
 1165                        20,3502   00015 0  FCADD3   DEC     13                                        4.....( 13)

 1166                        20,3503   00006 1  FCADD4   DEC      6          NO. PULSE BURSTS IN 1/2 AMP, SET2..(+ 6)
 1167                        20,3504   00005 1  FCADD5   DEC      5                                        SET3..(+ 5)
 1168                        20,3505   00004 0  FCADD6   DEC      4                                        SET4..(+ 4)

 1169  REP 37 LAST 918         4711             20MS     =       BIT2
R1170  STROKE TEST PACKAGE PROPER....

 1171  REP  2 LAST 103  E6,1667                          EBANK=  BUNKER

 1172                        20,3506  0 0006 1  HACK     EXTEND
 1173  REP  3 LAST 946     20,3507  23#667 1           QXCH    BUNKER      SAVE Q FOR DAP RETURN

 1174  REP  1              20,3510  3 4711 1           CAF     20MS        2DAPSX2(PASSES/DAP)X2(CS/PASS)=8CS=TVCDT
 1175  REP 45 LAST 918     20,3511  0 5140 1           TC      WAITLIST
 1176  REP  4 LAST 946     E6,1667                    EBANK=  BUNKER
 1177  REP  1              20,3512   03515 0           2CADR   HACKWLST
 1177  REP  1              20,3513   40066 0
 1178                      20,3514  1 3517 0           TCF     +3

 1179  REP  1              20,3515  3 4367 1  HACKWLST CAF     TCTSKOVR    ENTRY FROM WAITLIST
 1180  REP  5 LAST 946     20,3516  55#667 0           TS      BUNKER      BUNKER IS TC TASKOVER

 1181  REP 11 LAST 945     20,3517  3 1614 0           CA      STROKER     STROKE
 1182  REP  5 LAST 926     20,3520  26 054 1           ADS     TVCPITCH

 1183  REP 26 LAST 926     20,3521  3 4700 1           CAF     BIT11       RELEASE THE ERROR COUNTERS
 1184                      20,3522  0 0006 1           EXTEND
 1185  REP 10 LAST 932     20,3523  05 014 1           WOR     CHAN14
 1186  REP  4 LAST 945     20,3524  25#665 0           INCR    CADDY       COUNT DOWN THE NO. BURSTS, THIS SLOPE
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1187  REF  5  LAST  946  20,3525  4 1665 1          CS     CADDY
1188                     20,3526  0 0006 1          EXTEND
1189                     20,3527  6 3531 0          BZMF   +2
1190  REF  6  LAST  946  20,3530  0 1667 1          TC     BUNKER      EXIT, WHILE ON A SLOPE
1191  REF  3  LAST  945  20,3531  11∝670 0          CCS    REVS
1192  REF  1             20,3532  1 3552 1          TCF    REVUP       POSITIVE REVS
1193  REF  2  LAST  947  20,3533  1 3556 0          TCF    REVUP +4    FINAL REVERSAL, THIS SET

1194  REF  3  LAST  945  20,3534  25∝671 0          INCR   CARD        NEGATIVE REVS SET LAST PASS, READY FOR
1195  REF  4  LAST  947  20,3535  4 1671 1          CS     CARD              THE NEXT SET. CHECK IF NO MORE SETS
1196                     20,3536  0 0006 1          EXTEND
1197  REF  1             20,3537  1 3550 0          BZF    STROKILL    ALL SETS COMPLETED

1198  REF  5  LAST  947  20,3540  51∝671 0          INDEX  CARD
1199  REF  2  LAST  945  20,3541  3 3503 1          CAF    FCARD +4    PICK UP NO. REVERSALS (-), NEXT SET
1200  REF  4  LAST  947  20,3542  55∝670 0          TS     REVS        REINITIALIZE
1201  REF  6  LAST  947  20,3543  51∝671 0          INDEX  CARD
1202  REF  3  LAST  947  20,3544  4 3506 0          CS     FCARD +7    PICK UP NO. BURSTS IN 1/2AMP, NEXT SET
1203  REF  3  LAST  945  20,3545  55∝666 1          TS     N           REINITIALIZE
1204  REF  6  LAST  947  20,3546  55∝665 1          TS     CADDY
1205  REF  7  LAST  947  20,3547  0 1667 1          TC     BUNKER      EXIT, AT END OF SET
1206  REF  12 LAST  946  20,3550  55∝614 1  STROKILL TS     STROKER     RESET (TO +0) TO END TEST
1207  REF  8  LAST  947  20,3551  0 1667 1          TC     BUNKER      EXIT, STROKE TEST FINIS
1208  REF  5  LAST  947  20,3552  55∝670 0  REVUP   TS     REVS        ALL REVERSALS EXCEPT LAST OF SET
1209  REF  4  LAST  947  20,3553  3 1666 0          CA     N
1210                     20,3554  6 0000 1          DOUBLE             2 X 1/2AMP
1211                     20,3555  1 3561 1          TCF    +4

1212  REF  99 LAST  851  20,3556  4 4712 0    +4    CS     ONE         FINAL REVERSAL, THIS SET
1213  REF  6  LAST  947  20,3557  55∝670 0          TS     REVS        PREPARE TO BRANCH TO NEW BURST
1214  REF  5  LAST  947  20,3560  3 1666 0          CA     N           JUST RETURN TO ZERO, FINAL SLOPE OF SET
1215  REF  7  LAST  947  20,3561  55∝665 1          TS     CADDY       CADUP

1216  REF  13 LAST  947  20,3562  4 1614 1          CS     STROKER     CHANGE SIGN OF SLOPE
1217  REF  14 LAST  947  20,3563  55∝614 1          TS     STROKER
1218  REF  9  LAST  947  20,3564  0 1667 1          TC     BUNKER      EXIT AT A REVERSAL (SLOPE CHANGE)
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L TVCROLLDAP USER=S PAGE NO. 1 E0 S3

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R1000   PROGRAM NAME....ROLL AUTOPILOT, CONSISTING OF ROLLDAP,DURATION,NOROLL1,E
R1001   ORIGINAL CODING BY F.W.MARTIN, 1965 (SUNDIAL)                        TC.
R1003   LOG SECTION....ROLL AUTOPILOT   SUBROUTINE....DAPCSM
R1004   MOD BY ENGEL                   DATE 28 DEC, 1967 (SUNDISK TO COLOSSUS)
R1005   FUNCTIONAL DESCRIPTION....

R1006   .    *AN ADAPTATION OF THE LEM P-AXIS CONTROLLER
R1007        *MAINTAIN OGA WITHIN 5 DEG DEADBND OF OGAD, WHERE OGAD = OGA AS SEEN
R1008         BY IGNOVER (IGNITION)
R1009        *MAINTAIN OGA RATE LESS THAN 0.1 DEG/SEC LIMIT CYCLE RATE
R1012        *SWITCHING LOGIC IN PHASE PLANE.... SEE GSOP CHAPTER 3
R1013        *USES T6 CLOCK TO TIME JET FIRINGS
R1014        *MAXIMUM JET FIRING TIME = 2.56 SECONDS, LIMITED TO 2.5 IF GREATER
R1015        *MINIMUM JET FIRING TIME = 15 MS
R1016        *JET PAIRS FIRE ALTERNATELY
R1017        *AT LEAST 1/2 SECOND DELAY BEFORE A NEW JET PAIR IS FIRED
R1018        *JET FIRINGS MAY NOT BE EXTENDED, ONLY SHORTENED, WHEN RE-EVALUATION
R1019         OF A JET FIRING TIME IS MADE ON A LATER PASS

R1020   CALLING SEQUENCE....

R1021        *ROLLDAP CALL VIA WAITLIST, IN PARTICULAR BY TVCEXEC (EVERY 1/2 SEC)
R1022         WITH A 3CS DELAY TO ALLOW FREE TIME FOR OTHER RUPTS (DWNRPT, ETC.)

R1023   NORMAL EXIT MODES.... ENDOFJOB

R1024   ALARM OR ABORT EXIT MODES.... NONE

R1025   SUBROUTINES CALLED.....NONE

R1026   OTHER INTERFACES....

R1027        *TVCEXEC SETS UP ROLLDAP TASK EVERY 1/2 SECOND AND UPDATES 1/CONACC
R1028         EVERY 10 SECONDS (VIA MASSPROP AND S40.15)
R1029        *TVCRESTART PACKAGE WILL RE-START ROLL DAP AFTER A RESTART (PICKING
R1030         UP THE ORIGINAL OGAD)

R1032   ERASABLE INITIALIZATION REQUIRED....

R1033        *1/CONACC   (S40.15)
R1034        *OGAD (CDUX, AT IGNOVER)
R1035        *OGANOW  (CDUX AT TVCINIT4 AND TVCEXECUTIVE)
R1036        *OGAPAST  (OGANOW AT TVCEXECUTIVE)
R10362       *ROLLFIRE = TEMREG = ROLLWORD = 0   (MRCLEAN LOOP IN TVCDAPON)
R1037   OUTPUT....

R1038        *ROLL JET PAIR FIRINGS

R1040   DEBRIS.... MISCELLANEOUS, SHAREABLE WITH RCS/ENTRY, IN EBANK6 ONLY
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SOME NOTES ON THE ROLL AUTOPILOT, AND IN PARTICULAR, ON ITS SWITCHING
LOGIC.  SEE SECTION THREE OF THE GSOP (SUNDISK/COLOSSUS) FOR DETAILS.
SWITCHING LOGIC IN THE PHASE PLANE....

                              OGARATE
                                *
                                *
 * * * * * * * * * * *          *
                                *     (REGION 1, SEE TEXT BELOW)
                           *    *
                                *
* * * * * * *     (COAST)       *     ...PARABOLA (SWITCHING = CONTROL)
              *                 *
               *                *   *
                 *              *                (FIRE NEG ROLL JETS)
                   *            *      *
    (-DB,+LMCRATE)....*         *
                     *          *        *
                     *          *                              OGAERROR
*************************************************************************
                                *         *                (-AK, OGAERR)
                       *                  *      (REGION 6-PRIME)
                                          *      (SEE TEXT BELOW)
                         *      *          *
                                *            *     ...STRAIGHT LINE
   (FIRE POS ROLL JETS)     *   *              *
                                *   (COAST)       *
                                *                  * * * * * * * * * *
                                *                        -MINLIM
                                *    *
                                *
                                *          * * * * * * * * * * * * * * *
                                *                        -MAXLIM
                                *
                                *

SWITCHING PARABOLAS ARE CONTROL PARABOLAS, THUS REQUIRING KNOWLEDGE OF
     CONTROL ACCELERATION CONACC, OR ITS RECIPROCAL, 1/CONACC, THE TVC
     ROLL DAP GAIN  (SEE TVCEXECUTIVE VARIABLE GAIN PACKAGE).  JET
     FIRING TIME IS SIMPLY THAT REQUIRED TO ACHIEVE THE DESIRED OGARATE,
     SUBJECT TO THE LIMITATIONS DISCUSSED UNDER FUNCTIONAL DESCRIPTION,
     ABOVE.

THE THREE CONTROL REGIONS  (+, -, AND ZERO TORQUE) ARE COMPRIZED OF
     TWELVE SUBSET REGIONS  ( 1...6, AND THE CORRESPONDING 1-PRIME...
     6-PRIME ).  SEE SECTION 3 OF THE GSOP  (SUNDISK OR COLOSSUS)
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P1084   GIVEN THE OPERATING POINT NOT IN THE COAST REGION, THE DESIRED OGARATE
R1085         IS AT THE POINT OF PENETRATION OF THE COAST REGION BY THE CONTROL
R1086         PARABOLA WHICH PASSES THROUGH THE OPERATING POINT. FOR REGION 3
R1087         DESIRED OGARATE IS SIMPLY +-MAXLIM. FOR REGIONS 1 OR 6 THE SOLUTION
R1088         TO A QUADRATIC IS REQUIRED (THE PENETRATION IS ALONG THE STRAIGHT
R1089         LINE OR MINLIM BOUNDRY SWITCH LINES). AN APPROXIMATION IS MADE
R1090         INSTEAD. CONSIDER AN OPERATING POINT IN REGION 6. PASS A TANGENT TO
R1091         THE CONTROL PARABOLA THROUGH THE OPERATING POINT, AND FIND ITS
R1092         INTERSECTION WITH THE STRAIGHT LINE SECTION OF THE SWITCH CURVE...
R1093         THE INTERSECTION DEFINES DESIRED OGARATE. IF THE OPERATING POINT IS
R1094         CLOSE TO THE SWITCH LINE, THE APPROXIMATION IS QUITE GOOD (INDEED
R1095         THE APPROXIMATE AND QUADRATIC SOLUTIONS CONVERGE IN THE LIMIT AS
R1096         THE SWITCH LINE IS APPROACHED). IF THE OPERATING POINT IS NOT CLOSE
R1097         TO THE SWITCH LINE, THE APPROXIMATE SOLUTION GIVES VALID TREND
R1098         INFORMATION (DIRECTION OF DESIRED OGARATE) AT LEAST. THE
R1099         RE-EVALUATION OF DESIRED OGARATE IN SUBSEQUENT ROLL DAP PASSES (1/2
R1100         SECOND INTERVALS) WILL BENEFIT FROM THE CONVERGENT NATURE OF THE
R1101         APPROXIMATION.

R11021  FOR LARGE OGAERROR THE TANGENT INTERSECTS +-MINLIM SWITCH BOUNDRY BEFORE
R11022        INTERSECTING THE STRAIGHT LINE SWITCH. HOWEVER THE MINLIM IS
R11023        IGNORED IN COMPUTING THE FIRING TIME, SO THAT THE EXTENSION (INTO
R11024        THE COAST REGION) OF THE STRAIGHT LINE SWITCH IS WHAT IS FIRED TO.
R11025        IF THE ROLL DAP FINDS ITSELF IN THE COAST REGION BEFORE REACHING
R11026        THE DESIRED INTERSECTION (IE, IN THE REGION BETWEEN THE MINLIM
R11027        AND THE STRAIGHT LINE SWITCH) IT WILL EXIBIT NORMAL COAST-REGION
R11028        BEHAVIOR AND TURN OFF THE JETS. THE PURPOSE OF THIS FIRING POLICY
R11029        IS TO MAINTAIN STATIC ROLL STABILITY IN THE EVENT OF A JET
R1103         FAILED-ON.

R1113   WHEN THE OPERATING POINT IS IN REGION 1 THE SAME APPROXIMATION IS
R1114         MADE, BUT AT AN ARTIFICIALLY-CREATED OR DUMMY OPERATING POINT,
R1115         DEFINED BY.. OGAERROR = INTERSECTION OF CONTROL PARABOLA  AND
R1116         OGAERROR AXIS, OGARATE = +-LMCRATE WHERE SIGN IS OPPOSITE THAT OF
R1117         REAL OPERATING POINT RATE.  WHEN THE OPERATING POINT HAS PASSED
R1118         FROM REGION 1 TO REGION 6, THE DUMMY POINT IS NO LONGER REQUIRED,
R1119         AND THE SOLUTION REVERTS TO THAT OF A REGULAR REGION 6 POINT.
R1120   EQUATION FOR SWITCHING PARABOLA (SEE FIGURE ABOVE)....
R1121                                    2
R1122         SOGAERROR = (DB - (SOGARATE) (1/CONACC)/2) SGN(SOGARATE)
R1123   EQUATION FOR SWITCHING STRAIGHT LINE SEGMENT....

R1124         SOGARATE = -(-SLOPE)(SOGAERROR) - SGN(SOGARATE) INTERCEP

R1125                  WHERE  INTERCEP = DB(-SLOPE) - LMCRATE
```

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R1126   EQUATION FOR INTERSECTION, CONTROL PARABOLA AND STRAIGHT SWITCH LINE....

R1127       DOGADOT = NUM/DEN, WHERE
R1128                                    2
R1129           NUM = (-SLOPE)(OGARATE) (1/CONACC)
R1130                   +SGN(DELOGA)(-SLOPE)(OGAERROR - SGN(DELOGA)(DB))
R1131                   +LMCRATE

R1132           DEN = (-SLOPE)(OGARATE)(1/CONACC) - SGN(DELOGA)
R1133                                          2
R1134           DELOGA = OGAERROR - (DB - (OGADOT) (1/CONACC)/2)SGN(OGADOT)
R1135   FOR REGIONS 6 AND 6-PRIME  USE ACTUAL OPERATING POINT  (OGA, OGARATE)
R1136        FOR OGAERROR AND OGARATE IN THE INTERSECTION EQUATIONS ABOVE.
R1137        FOR REGIONS 1 AND 1-PRIME  USE DUMMY OPERATING POINT FOR OGAERROR
R1138        AND OGARATE,  WHERE THE DUMMY POINT IS GIVEN BY....
R1139        OGAERROR= DELOGA + DB SGN(OGARATE)
R1140        OGARATE= -LMCRATE SGN(OGARATE)

R1141   NOTE, OGAERROR = OGA - OGAD  USES DUMMY REGISTER  OGA IN ROLL DAP CODING
R1142         ALSO,AT POINT WHERE DOGADOT IS COMPUTED, REGISTER DELOGA IS USED
R1143         AS A DUMMY REGISTER FOR THE OGAERROR IN THE NUM EQUATION ABOVE
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P11432 ROLLDAP CODING....

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 2000   REF   3  LAST  917   16,2000                          SETLOC  DAPROLL
 2001                       16,3313                          BANK
 2002   REF   9  LAST  904   E6,1672                          EBANK=  OGANOW
 2003   REF   1                                               COUNT*  $$/ROLL
 2006   REF  10  LAST  952   16,3313  31-672 0  ROLLDAP      CAE     OGANOW      OGA RATE ESTIMATOR...SIMPLE FIRST-ORDER
 2007                       16,3314  0 0006 1                EXTEND                  DIFFERENCE (SAMPLE TIME = 1/2 SEC)
 2008   REF   3  LAST  904   16,3315  21-673 0                MSU     OGAPAST
 2009                       16,3316  0 0006 1                EXTEND
 2010   REF  34  LAST  906   16,3317  7 4706 0                MP      BIT5
 2011   REF 207  LAST  945   16,3320  22 000 1                LXCH    A
 2012   REF   1               16,3321  55-533 1                TS      OGARATE     SC.AT B-4 REV/SEC

R2017   COMPUTATIONS WHICH FOLLOW USE OGA FOR OGAERR (SAME REGISTER)
R2018   EXAMINE DURATION OF LAST ROLL FIRING IF JETS ARE NOW ON.
 2019   REF   2  LAST  102   16,3322  3 1611 0  DURATION      CA      ROLLFIRE    SAME SGN AS PRESENT TORQ,MAGN=POSMAX
 2020                       16,3323  0 0006 1                EXTEND
 2021                       16,3324  1 3326 1                BZF     +2          ROLL JETS ARE NOW OFF.
 2022   REF   1               16,3325  1 3334 1                TCF     ROLLOGIC    ENTER LOGIC,JETS NOW ON.

 2023   REF   2  LAST  102   16,3326  31-613 1                CAE     TEMREG      EXAMINE LAST FIRING INTERVAL
 2024                       16,3327  0 0006 1                EXTEND              IF POSITIVE, DONT FIRE
 2025   REF   2  LAST  952   16,3330  1 3334 1                BZF     ROLLOGIC    ENTER LOGIC, JETS NOW OFF.

 2026   REF 167  LAST  945   16,3331  3 4714 1                CAF     ZERO        JETS HAVE NOT BEEN OFF FOR 1/2 SEC. WAIT
 2027   REF   3  LAST  952   16,3332  55-613 0                TS      TEMREG      RESET TEMREG
 2028   REF  46  LAST  909   16,3333  1 5213 0  WAIT1/2       TCF     TASKOVER    EXIT ROLL DAP

R2029   COMPUTE DB-(1/2 CONACC) (OGARATE)SQ  (1/2 IN THE SCALING)
 2030   REF   2  LAST  952   16,3334  4 1533 1  ROLLOGIC      CS      OGARATE     SCALED AT 2(-4) REV/SEC
 2031                       16,3335  0 0006 1                EXTEND
 2032   REF   4  LAST  910   16,3336  7 1650 1                MP      1/CONACC    SCALED AT 2(+9) SEC SQ /REV
 2033                       16,3337  0 0006 1                EXTEND
 2034   REF   3  LAST  952   16,3340  7 1533 1                MP      OGARATE
 2035   REF   1               16,3341  6 3727 0                AD      DB          SCALED AT 2(+0) REV
 2036   REF   4  LAST  952   16,3342  55-613 0                TS      TEMREG      QUANTITY SCALED AT 2(+0) REV.

R2037   GET SIGN OF OGARATE
 2038   REF   4  LAST  952   16,3343  3 1533 0                CA      OGARATE
 2039                       16,3344  0 0006 1                EXTEND
 2040                       16,3345  6 3350 1                BZMF    +3          LET SGN(0) BE NEGATIVE
 2041   REF  63  LAST  900   16,3346  3 4712 1                CA      BIT1
 2042                       16,3347  1 3351 1                TCF     +2
 2043   REF  64  LAST  952   16,3350  4 4712 0                CS      BIT1
 2044   REF   2  LAST  103   16,3351  55-676 0                TS      SGNRT       + OR -  2(-14)

R2045   CALCULATE DISTANCE FROM SWITCH PARABOLA,DELOGA
 2046                       16,3352  0 0006 1                EXTEND
 2047   REF   5  LAST  952   16,3353  7 1613 0                MP      TEMREG      SGN(OGARATE) TEMREG NOW IN L
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2048  REF 101  LAST  945   16,3354  4 0001 1          CS    L
2049  REF   3  LAST  103   16,3355  6 1674 0          AD    OGA          SCALED AT 2(+0) REV
2050  REF   2  LAST  103   16,3356  55¢677 1 DELOGAC  TS    DELOGA       SC.AT B+0 REV, PLUS TO RIGHT OF C-PARAB
R2051 EXAMINE SGN(DELOGA) AND CREATE CA OR CS INSTR. DEPENDING UPON SIGN.
2052                        16,3357  0 0006 1          EXTEND
2053                        16,3360  6 3363 1          BZMF  +3
2054  REF  11  LAST  688   16,3361  3 4371 0          CAF   PRIO30       =CA  (30000)
2055                        16,3362  1 3364 1          TCF   +2
2056  REF  38  LAST  906   16,3363  3 4674 0          CAF   BIT15        =CS  (40000)
2057  REF   2  LAST  103   16,3364  55¢700 0          TS    I

2058  REF   3  LAST  953   16,3365  51¢700 1          INDEX I            TSET ON  I SGN(OGARATE)
2059  REF   3  LAST  952   16,3366  0 1676 1          0     SGNRT        CA OR CS
2060                        16,3367  4 0000 0          COM
2061                        16,3370  0 0006 1          EXTEND
2062  REF   1               16,3371  6 3442 0 REG1TST  BZMF  ROLLON       IF REGION 1 (DELOGA OGARATE SAME SIGN)

R2063 NO JET FIRE YET. TEST FOR MAX OGARATE
2064  REF   4  LAST  953   16,3372  51¢700 1          INDEX I
2065  REF   5  LAST  952   16,3373  0 1533 0          0     OGARATE      CA OR CS...BOTH MUST BE NEG. HERE
2066  REF   2  LAST  103   16,3374  55¢701 1          TS    IOGARATE     I.E. I OGARATE
2067  REF   1               16,3375  6 3735 0          AD    MAXLIM       SCALED AT 2(-4) REV/SEC
2068                        16,3376  0 0006 1          EXTEND
2069  REF   1               16,3377  6 3521 1 REG3TST  BZMF  RATELIM      IF REGION 3 (RATES TOO HIGH, FIRE JETS)

R2070 COMPUTATION OF I((-SLOPE)OGA + OGARATE) - INTERCEPT..NOTE THAT STR. LINE
R2071 SWITCH SLOPE IS (SLOPE) DEG/SEC/DEG,A NEG. QUANTITY
2072  REF   6  LAST  953   16,3400  3 1533 0          CA    OGARATE
2073                        16,3401  0 0006 1          EXTEND
2074  REF  50  LAST  932   16,3402  7 4675 0          MP    BIT14
2075  REF   6  LAST  952   16,3403  55¢613 0          TS    TEMREG
2076  REF   4  LAST  953   16,3404  3 1674 0          CA    OGA
2077                        16,3405  0 0006 1          EXTEND
2078  REF   1               16,3406  7 3730 1          MP    -SLOPE
2079                        16,3407  20 001 1          DDOUBL
2080                        16,3410  20 001 1          DDOUBL
2081                        16,3411  20 001 1          DDOUBL               (OGA ERROR MUST BE LESS THAN +-225 DEG)
2082  REF   7  LAST  953   16,3412  6 1613 1          AD    TEMREG

2083  REF   5  LAST  953   16,3413  51¢700 1          INDEX I
2084  REF 208  LAST  952   16,3414  0 0000 1          0     A            I((-SLOPE)OGA+OGARATE) AT 2(-3)REV/SEC
2085                        16,3415  4 0000 0          COM
2086  REF   1               16,3416  6 3732 1          AD    INTERCEP     SCALED AT 2(-3) REV.
2087                        16,3417  4 0000 0          COM
2088                        16,3420  0 0006 1          EXTEND
2089  REF   1               16,3421  6 3632 0 REG2TST  BZMF  NOROLL       IF REGION 2 (COAST SIDE OF STRT LINE)

R2090 CHECK TO SEE IF OGARATE IS ABOVE MINLIM
2091  REF   3  LAST  953   16,3422  3 1701 0          CA    IOGARATE     ALWAYS NEGATIVE
2092  REF   1               16,3423  6 3733 0          AD    MINLIM       SCALED AT 2(-4) REV/SEC
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 2093                          16,3424  0 0006 1           EXTEND
 2094  REP   2 LAST  953       16,3425  6 3632 0  REG4TST  BZMF   NOROLL          IF REGION 4 (COAST SIDE OF MINLIM)

R2095  ALL AREAS CHECKED EXCEPT LAST AREA...NO FIRE IN THIS SMALL SEGMENT
 2096  REP   6 LAST  953       16,3426  51"700 1           INDEX  I
 2097  REP   5 LAST  953       16,3427  0 1674 0           0      OGA
 2098                          16,3430  4 0000 0           COM
 2099  REP   2 LAST  952       16,3431  6 3727 0           AD     DB
 2100                          16,3432  4 0000 0           COM
 2101                          16,3433  0 0006 1           EXTEND
 2102  REP   3 LAST  954       16,3434  6 3632 0  REG5TST  BZMF   NOROLL          IF REGION 5 (COAST SIDE OF DB)
R2103  JETS MUST FIRE NOW.OGARATE IS NEG.(OR VISA VERSA).USE DIRECT STR. LINE.
R2104  DELOGA AND DELOGART ARE USED AS DUMMY VARIABLES IN THE SOLUTION OF A
R2105  STRAIGHT LINE APPROXIMATION TO A QUADRATIC SOLUTION OF THE INTERSECTION
R2106  OF THE CONTROL PARABOLA AND THE STRAIGHT-LINE SWITCH LINE. THE STRAIGHT
R2107  LINE IS THE TANGENT TO THE CONTROL PARABOLA AT THE OPERATING POINT. (FOR
R2108  OPERATING POINTS IN REGIONS  6 AND 6-PRIME)
 2109  REP   6 LAST  954       16,3435  31"674 0  REGION6  CAE    OGA             USE ACTUAL OPERATING POINT FOR TANGENT
 2110  REP   3 LAST  953       16,3436  55"677 1           TS     DELOGA          ACTUAL STATE
 2111  REP   7 LAST  953       16,3437  3 1533 0           CA     OGARATE
 2112  REP   2 LAST  103       16,3440  55"675 0           TS     DELOGART        ACTUAL STATE,I.E. DEL OGARATE
 2113  REP   1                 16,3441  1 3451 0           TCF    ONROLL

R2114  JETS ALSO FIRE FROM HERE EXCEPT OGARATE IS POS(VISA VERSA),USE INDIRECT
R2115  STRAIGHT LINE ESTABLISHED BY TANGENT TO A CONTROL PARABOLA AT  ((DELOGA
R2116  + DB SGN(DELOGA) ), -LMCRATE SGN(DELOGA) )        (THIS IS THE DUMMY
R2117  OPERATING POINT FOR OPERATING POINTS IN REGIONS 1 AND 1-PRIME )
 2118  REP   7 LAST  954       16,3442  51"700 1  ROLLON   INDEX  I
 2119  REP   3 LAST  954       16,3443  0 3727 0           0      DB
 2120  REP   4 LAST  954       16,3444  27"677 1           ADS    DELOGA          DELOGA WAS DIST. FROM SWITCH PARABOLA

 2121  REP   1                 16,3445  4 3731 0           CS     LMCRATE         LIMIT CYCLE RATE AT 2(-4) REV/SEC
 2122  REP   8 LAST  954       16,3446  51"700 1           INDEX  I
 2123  REP 209 LAST  953       16,3447  0 0000 1           0      A
 2124  REP   3 LAST  954       16,3450  55"675 0           TS     DELOGART        EVALUATE STATE FOR INDIRECT LINE.

R2125  SOLVE STRAIGHT LINES SIMULTANEOUSLY TO OBTAIN DESIRED OGARATE.
 2126                          16,3451  0 0006 1  ONROLL   EXTEND                 DELOGART IN ACC. ON ARRIVAL
 2127  REP   5 LAST  952       16,3452  7 1650 1           MP     1/CONACC
 2128                          16,3453  6 0000 1           DOUBLE
 2129                          16,3454  0 0006 1           EXTEND
 2130  REP   2 LAST  953       16,3455  7 3730 1           MP     -SLOPE
 2131  REP   8 LAST  953       16,3456  55"613 0           TS     TEMREG          2(-SLOPE)RATE /CONACC
 2132                          16,3457  0 0006 1           EXTEND
 2133  REP   4 LAST  954       16,3460  7 1675 0           MP     DELOGART
 2134  REP   5 LAST  954       16,3461  55"675 0           TS     DELOGART        2(-SLOPE)(RATESQ)/CONACC
 2135  REP  27 LAST  946       16,3462  4 4700 0           CS     BIT11
 2136  REP   9 LAST  954       16,3463  51"700 1           INDEX  I
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2137   REP 210  LAST  954   16,3464  0 0000 1            0       A
2138   REP   9  LAST  954   16,3465  27'613 0  RATEDEN   ADS     TEMREG      DENOMINATOR COMPLETED

2139   REP  10  LAST  954   16,3466  51'700 1            INDEX   I
2140   REP   5  LAST  954   16,3467  0 1677 0            0       DELOGA
2141                        16,3470  4 0000 0            COM
2142   REP   4  LAST  954   16,3471  6 3727 0            AD      DB
2143                        16,3472  4 0000 0            COM
2144                        16,3473  0 0006 1            EXTEND
2145   REP   3  LAST  954   16,3474  7 3730 1            MP      -SLOPE
2146   REP   6  LAST  954   16,3475  27'675 0            ADS     DELOGART
2147   REP   2  LAST  954   16,3476  3 3731 1            CA      LMCRATE
2148                        16,3477  0 0006 1            EXTEND
2149   REP  28  LAST  954   16,3500  7 4700 0            MP      BIT11
2150   REP   7  LAST  955   16,3501  6 1675 1  RATENUM   AD      DELOGART    NUMERATOR COMPLETED

2151   REP 102  LAST  953   16,3502  56 001 0            XCH     L           PLACE NUMERATOR IN L FOR OVERFL. CHECK
2152   REP 168  LAST  952   16,3503  3 4714 1            CA      ZERO
2153                        16,3504  0 0006 1            EXTEND
2154   REP  10  LAST  955   16,3505  11'613 0            DV      TEMREG      OVERFLOW, IF ANYTHING, NOW APPEARS IN A
2155                        16,3506  0 0006 1            EXTEND
2156   REP   1              16,3507  1 3515 1            BZF     DVOK        NO OVERFLOW....(0,L)/TEMREG = 0,L

2157   REP 211  LAST  955   16,3510  10 000 0  MINLIMAP  CCS     A
2158   REP  19  LAST  900   16,3511  3 4672 0            CAP     POSMAX          POSITIVE OVERFLOW
2159   REP   1              16,3512  1 3524 0            TCF     ROLLSET
2160   REP  20  LAST  955   16,3513  4 4672 1            CS      POSMAX          NEGATIVE OVERFLOW
2161   REP   2  LAST  955   16,3514  1 3524 0            TCF     ROLLSET

2162   REP 212  LAST  955   16,3515  22 000 1  DVOK      LXCH    A           PUT NUMERATOR BACK INTO A, 0 IN L
2163                        16,3516  0 0006 1            EXTEND
2164   REP  11  LAST  955   16,3517  11'613 0            DV      TEMREG      RESULT OF DIVISION IS DESIRED OGARATE
2165   REP   3  LAST  955   16,3520  1 3524 0            TCF     ROLLSET         ( SCALED AT B-4 REV/SEC )
2173   REP   2  LAST  953   16,3521  4 3735 1  RATELIM   CS      MAXLIM
2174   REP  11  LAST  955   16,3522  51'700 1            INDEX   I
2175   REP 213  LAST  955   16,3523  0 0000 1            0       A           IF I = CA, DESIRED RATE IS   -MAXLIM

R2176  BASED ON DESIRED RATE - PRESENT RATE,COMPUTE JET FIRE TIME
2177   REP  12  LAST  955   16,3524  55'613 0  ROLLSET   TS      TEMREG      STORE DESIRED OGARATE (SCALED B-4)
21771                       16,3525  0 0006 1            EXTEND
2178   REP   8  LAST  954   16,3526  61'533 0            SU      OGARATE     RATE DIFF. SCALED AT 2(-4) REV/SEC
21781  REP  13  LAST  955   16,3527  55'613 0            TS      TEMREG          OVERFLOW PROTECT
21782                       16,3530  1 3533 0            TCF     +3                  B       B
217821 REP 214  LAST  955   16,3531  50 000 1            INDEX   A                   B       B
217822 REP   2  LAST  842   16,3532  4 4673 0            CS      LIMITS              B       B
2179                        16,3533  0 0006 1            EXTEND
2180   REP   1              16,3534  7 7665 1            MP      T6SCALE     T6SCALE = 8/10.24
2181                        16,3535  0 0006 1            EXTEND
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 2182  REF   6  LAST  954   16,3536  7 1650 1            MP      1/CONACC      SCALED AT 2(+9) SECSQ/REV.
 2183                       16,3537  20 001 1            DDOUBL
21831                       16,3540  20 001 1            DDOUBL
 2184  REF  14  LAST  955   16,3541  55=613 0            TS      TEMREG        OVERFLOW PROTECT
21841                       16,3542  1 3545 1            TCF     +3                  #       #
21842  REF 215  LAST  955   16,3543  50 000 1            INDEX   A                   #       #
21843  REF   3  LAST  955   16,3544  4 4673 0            CS      LIMITS              #       #
 2185  REF  15  LAST  956   16,3545  55=613 0            TS      TEMREG        JET FIRE TIME AT 625 MICROSEC/BIT
 2186                       16,3546  0 0006 1            EXTEND                POS MEANS POSITIVE ROLL TORQUE.
 2187  REF   4  LAST  954   16,3547  1 3632 1            BZF     NOROLL

R2188  JET FIRE TIME IS NZ, ARE JETS ON NOW.
21881  REF  16  LAST  956   16,3550  31=613 1            CAE     TEMREG        DESIRED CHANGE IN OGARATE
 2189                       16,3551  0 0006 1            EXTEND
 2190  REF   3  LAST  952   16,3552  7 1611 1            MP      ROLLFIRE      (SGN OF TORQUE..ZERO IF JETS NOW OFF)
 2191  REF 216  LAST  956   16,3553  10 000 0            CCS     A
 2192  REF   1               16,3554  1 3560 0            TCF     MOREROLL      CONTINUE FIRING WITH PRESENT POLARITY
 2193  REF   1               16,3555  1 3563 0            TCF     NEWROLL       START NEW FIRING NOW, PLUS
 2194  REF   5  LAST  958   16,3556  1 3632 1            TCF     NOROLL        TERMINATE OLD FIRING, NEW SIGN REQUESTED
 2195  REF   2  LAST  956   16,3557  1 3563 0            TCF     NEWROLL       START NEW FIRING NOW, MINUS

R2196  CONTINUE PRESENT FIRING
 2197  REF 169  LAST  955   16,3560  3 4714 1  MOREROLL  CAF     ZERO
 2198  REF  12  LAST  955   16,3561  55=700 0            TS      I             USE TEMP. AS MOREROLL SWITCH
 2199  REF   1               16,3562  1 3574 0            TCF     MAXTFIRE

R2200  START NEW FIRING BUT CHECK IF GREATER THAN MINIMUM FIRE TIME.
 2201  REF  17  LAST  956   16,3563  11=613 0  NEWROLL   CCS     TEMREG        CALL THIS T6FIRE
 2202  REF 100  LAST  947   16,3564  6 4712 1            AD      ONE
 2203                       16,3565  1 3567 1            TCF     +2
 2204  REF 101  LAST  956   16,3566  6 4712 1            AD      ONE
 2205                       16,3567  4 0000 0            COM                   -MAG(T6FIRE)
 2206  REF   1               16,3570  6 3736 0            AD      TMINFIRE      TMINFIRE-MAG(T6FIRE)
 2207                       16,3571  4 0000 0            COM
 2208                       16,3572  0 0006 1            EXTEND
 2209  REF   6  LAST  956   16,3573  6 3632 0  MINTST    BZMF    NOROLL        IF NOT GREATER THAN TMINFIRE (NEW FIRE)

R2210  PROCEED WITH NEW FIRING BUT NOT LONGER THAN TMAXFIRE
 2211  REF  18  LAST  956   16,3574  3 1613 1  MAXTFIRE  CA      TEMREG
 2212                       16,3575  0 0006 1            EXTEND
 2213  REF   1               16,3576  7 4710 1            MP      1/TMXFIR      I.E. 1/TMAXFIRE
 2214                       16,3577  0 0006 1            EXTEND
 2215  REF   1               16,3600  1 3606 0  MAXTST    BZF     NOMXFIRE      IF LESS THAN TMAXFIRE

 2216  REF 217  LAST  956   16,3601  10 000 0            CCS     A
 2217  REF   1               16,3602  3 3737 1            CAF     TMAXFIRE      USE MAXIMUM
 2218                       16,3603  1 3605 0            TCF     +2
 2219  REF   2  LAST  956   16,3604  4 3737 0            CS      TMAXFIRE      USE MAXIMUM
 2220  REF  19  LAST  956   16,3605  55=613 0            TS      TEMREG
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R2221   SET UP SIGN OF REQUIRED TORQUE
 2222   REF  20  LAST  956   16,3606  11-613 0  NOMXFIRE CCS   TEMREG     FOR TORQUE SIGN
 2223   REF  21  LAST  955   16,3607  3 4672 0           CA    POSMAX     POSITIVE TORQUE REQUIRED
 2224                        16,3610  1 3612 0           TCF   +2
 2225   REF   4  LAST  938   16,3611  3 4674 0           CA    NEGMAX     NEGATIVE TORQUE REQUIRED
 2226   REF   4  LAST  956   16,3612  55-611 1           TS    ROLLFIRE   SET ROLLFIRE FOR + OR - TORQUE

 2227                        16,3613  4 0000 0           COM              COMPLEMENT... POS. FOR NEG. TORQUE
 2228                        16,3614  0 0006 1           EXTEND
 2229                        16,3615  6 3620 0           BZMF  +3         POSITIVE TORQUE REQUIRED
 2230   REF  21  LAST  957   16,3616  4 1613 0           CS    TEMREG
 2231   REF  22  LAST  957   16,3617  55-613 0           TS    TEMREG

 2232   REF  13  LAST  956   16,3620  3 1700 1  FIRELOOK CA    I          IS IT MOREROLL
 2233                        16,3621  0 0006 1           EXTEND
 2234   REF   1              16,3622  1 3624 0           BZF   FIREPLUG   YES
 2235   REF   1              16,3623  1 3635 0           TCF   JETROLL    MAG(T6FIRE) NOW IN TEMREG

 2236   REF   1              16,3624  30 031 0  FIREPLUG CAE   TIME6      CHECK FOR EXTENDED FIRING
 2237                        16,3625  0 0006 1           EXTEND
 2238   REF  23  LAST  957   16,3626  61-613 1           SU    TEMREG
 2241                        16,3627  0 0006 1           EXTEND
 2242   REF  47  LAST  952   16,3630  6 5213 1  EXTENTST BZMF  TASKOVER   IF EXTENSION WANTED, DONT, EXIT ROLL DAP
 2243   REF   2  LAST  957   16,3631  1 3635 0           TCF   JETROLL

 2244   REF 170  LAST  956   16,3632  4 4714 0  NOROLL   CS    ZERO       COAST....(NEG ZERO FOR TIME6)
 2245   REF   5  LAST  957   16,3633  55-611 1           TS    ROLLFIRE   NOTE, JETS CAN FIRE NEXT PASS
 2246   REF  24  LAST  957   16,3634  55-613 0           TS    TEMREG

 2247                        16,3635  0 0006 1  JETROLL  EXTEND
 2248   REF   1              16,3636  3 3726 1           DCA   NOROL1T6
 2249   REF   2  LAST  127   16,3637  53-311 1           DXCH  T6LOC
 2250   REF  25  LAST  957   16,3640  3 1613 1           CA    TEMREG     ENTER JET FIRING TIME
 2251   REF   2  LAST  957   16,3641  54 031 1           TS    TIME6

 2252   REF  14  LAST  957   16,3642  3 1700 1           CA    I          I=0 IF MOREROLL,KEEP SAME JETS ON
 2253                        16,3643  0 0006 1           EXTEND
 2254   REF  48  LAST  957   16,3644  1 5213 0  SAMEJETS BZF   TASKOVER   IF JETS ON KEEP SAME JETS. EXIT ROLL DAP

 2255   REF   6  LAST  957   16,3645  11-611 1           CCS   ROLLFIRE
 2256   REF   1              16,3646  1 3652 1           TCF   +TORQUE
 2257   REF   1              16,3647  1 3713 0           TCF   T6ENABL
 2258   REF   1              16,3650  1 3673 1           TCF   -TORQUE
 2259   REF   2  LAST  957   16,3651  1 3713 0           TCF   T6ENABL

R2260   PROCEED WITH + TORQUE
 2261   REF   2  LAST  102   16,3652  3 1612 0  +TORQUE   CA    ROLLWORD    WHAT WAS THE LAST +TORQUE COMBINATION
 2262   REF  65  LAST  952   16,3653  7 4712 0           MASK  BIT1       WAS IT NO.9-11
 2263                        16,3654  0 0006 1           EXTEND
 2264   REF   1              16,3655  1 3665 0           BZF   NO.9-11    NOT 9-11, SO USE IT THIS TIME
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2265  REF  66  LAST  957   16,3656  4 4712 0  NO.13-15  CS    BIT1
2266  REF   3  LAST  957   16,3657  7 1612 1            MASK  ROLLWORD
2267  REF   4  LAST  958   16,3660  55∝612 1            TS    ROLLWORD     CHANGE BIT 1 TO ZERO
2268  REF   1               16,3661  3 4732 0            CAF   +ROLL2
2269                        16,3662  0 0006 1            EXTEND
2270  REF   2  LAST  179   16,3663  01 006 0            WRITE CHAN6
2271  REF   3  LAST  957   16,3664  1 3713 0            TCF   T6ENABL

2272  REF  67  LAST  958   16,3665  3 4712 1  NO.9-11   CAF   BIT1         1ST + JETS TO FIRE (MRCLEAN OS ROLLWORD)
2273  REF   5  LAST  958   16,3666  27∝612 1            ADS   ROLLWORD     CHANGE BIT 1 TO ONE
2274  REF   1               16,3667  3 4715 0            CAF   +ROLL1
2275                        16,3670  0 0006 1            EXTEND
2276  REF   3  LAST  958   16,3671  01 006 0            WRITE CHAN6
2277  REF   4  LAST  958   16,3672  1 3713 0            TCF   T6ENABL

2278  REF   6  LAST  958   16,3673  3 1612 0  -TORQUE   CA    ROLLWORD     WHAT WAS LAST -TORQUE COMBINATION
2279  REF  38  LAST  946   16,3674  7 4711 0            MASK  BIT2         WAS IT NO.12-10
2280                        16,3675  0 0006 1            EXTEND
2281  REF   1               16,3676  1 3706 1            BZF   NO.12-10     NOT 12-10, SO USE IT THIS TIME

2282  REF  39  LAST  958   16,3677  4 4711 0  NO.16-14   CS    BIT2
2283  REF   7  LAST  958   16,3700  7 1612 1            MASK  ROLLWORD
2284  REF   8  LAST  958   16,3701  55∝612 1            TS    ROLLWORD     CHANGE BIT 2 TO ZERO
2285  REF   1               16,3702  3 3740 1            CAF   -ROLL2
2286                        16,3703  0 0006 1            EXTEND
2287  REF   4  LAST  958   16,3704  01 006 0            WRITE CHAN6
2288  REF   5  LAST  958   16,3705  1 3713 0            TCF   T6ENABL

2289  REF  40  LAST  958   16,3706  3 4711 1  NO.12-10   CAF   BIT2         1ST -JETS TO FIRE (MRCLEAN OS ROLLWORD)
2290  REF   9  LAST  958   16,3707  27∝612 1            ADS   ROLLWORD     CHANGE BIT 2 TO ONE
2291  REF   1               16,3710  3 4377 0            CAF   -ROLL1
2292                        16,3711  0 0006 1            EXTEND
2293  REF   5  LAST  958   16,3712  01 006 0            WRITE CHAN6

2294  REF  39  LAST  953   16,3713  3 4674 0  T6ENABL    CAF   BIT15
2295                        16,3714  0 0006 1            EXTEND
2296  REF   8  LAST  577   16,3715  05 013 0            WOR   CHAN13
2297  REF  49  LAST  957   16,3716  1 5213 0  RDAPEND    TCF   TASKOVER     EXIT ROLL DAP
```

```
P2298   THIS T6 TASK SHUTS OFF ALL ROLL JETS
 2299   REF  15  LAST  938    16,3717   22 016 0  NOROLL1  LXCH   BANKRUPT      SHUT OFF ALL (ROLL) JETS, (A T6 TASK
 2300   REF 171  LAST  957    16,3720   3 4714 1           CAF    ZERO             CALLED BY ..JETROLL..)
 2301   REF   7  LAST  957    16,3721   55«611 1           TS     ROLLFIRE      ZERO INDICATES JETS NOW OFF
 2302                         16,3722   0 0008 1           EXTEND
 2303   REF   6  LAST  958    16,3723   01 008 0  KILLJETS WRITE  CHAN6
 2304   REF   4  LAST  936    16,3724   1 5224 1           TCF    NOQRSM
```

P2305 CONSTANTS FOR ROLL AUTOPILOT....

```
 2306  REF  11  LAST  923   E6,1742                          EBANK= BZERO
 2307  REF   1              16,3725  03717 0  NOROL1T6  2CADR  NOROLL1
 2307  REF   1              16,3726  34066 0

 2309                       16,3727  00344 1  DB        DEC   .01388889      DEAD BAND (5 DEG), SC.AT B+0 REV

 2310                       16,3730  06315 0  -SLOPE    DEC   0.2             -SWITCHLINE SLOPE(0.2 PER SEC) SC.AT B+0
A2311                                                                            PER SEC
 2312                       16,3731  00111 0  LMCRATE   DEC   .00027778 B+4   LIMIT CYCLE RATE (0.1 DEG/SEC) SC.AT
A2313                                                                            B-4 REV/SEC
 2314                       16,3732  00510 0  INTERCEP  DEC   .0025 B+3       DB(-SLOPE) - LMCRATE, SC.AT B-3 REV/SC

 2315                       16,3733  01330 0  MINLIM    DEC   .00277778 B+4   RATELIM,MIN (1DEG/SEC), SC.AT B-4 REV/SC

 2316                       16,3734  00027 1  1/MINLIM  DEC   360 B-18        RECIPROCAL THEREOF, SHIFTED 14 RIGHT

 2317                       16,3735  07071 0  MAXLIM    DEC   .01388889 B+4   RATELIM,MAX (5DEG/SEC), SC.AT B-4 REV/SC

 2318                       16,3736  00030 1  TMINFIRE  DEC   1.5 B+4         15 MS (14 MIN), SC.AT 16 BITS/CS

 2319                       16,3737  07640 1  TMAXFIRE  DEC   250 B+4         2.5 SEC, SC.AT 16 BITS/CS

 2320  REF  28  LAST  941     4710           1/TMXFIR  =     BIT3            RECIPROCAL THEREOF, SHIFTED 14 RIGHT,
A23201                                                                           ROUNDS TO OCT00004, SO ALLOWS 2.56
A23202                                                                           SEC FIRINGS BEFORE APPLYING LIMIT
23203  REF   4  LAST  787     7665           T6SCALE   =     PRIO31          (B+3) (16BITS/CS) (100CS/SEC)

 2321  REF  23  LAST  906     4715           +ROLL1    =     FIVE            ONBITS FOR JETS 9 AND 11
 2322  REF   2  LAST  197     4732           +ROLL2    =     OCT120          ONBITS FOR JETS 13 AND 15
 2323  REF   5  LAST  645     4377           -ROLL1    =     TEN             ONBITS FOR JETS 12 NAD 10
 2324                       16,3740  00240 1  -ROLL2    OCT   240             ONBITS FOR JETS 16 AND 14
```

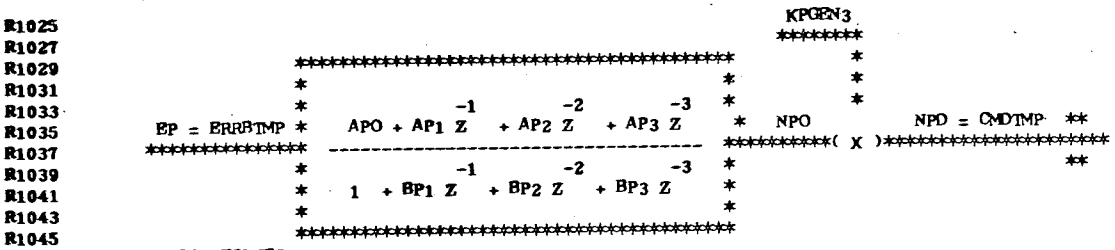
R1000 PROGRAM NAME.... GEN3DAP FILTERS, CONSISTING OF NP0NODE, NP1NODE, NY0NODE, NY1NODE, ETC.
R1002 LOG SECTION.... GEN3DAP FILTERS SUBROUTINE....DAPCSM
R1003 MOD BY ENGEL 20 OCT, 1967

R1004 FUNCTIONAL DESCRIPTION....

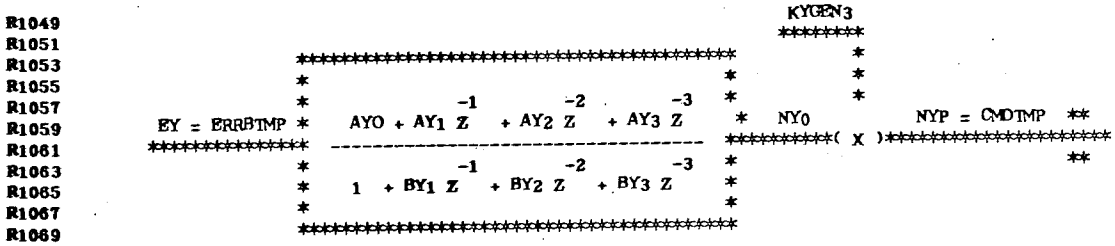
R1005 THE GEN3DAP FILTER PACKAGE IS DESIGNED TO PROVIDE FLEXIBLE, LAST-MINUTE CHANGEABLE DIGITAL AUTOPILOT
R1007 FILTERS FOR LEM-OFF FLIGHT. GROUNDRULES FOR THE DESIGN AND USE OF THE PACKAGE ARE AS FOLLOWS.....

R1009 1. FILTER COEFFICIENTS AND GAINS IN ERASABLE MEMORY
R1011 2. UP TO THIRD-ORDER NUMERATOR OR DENOMINATOR
R1013 3. OPERATIONAL FIT WITHIN THE STRUCTURE OF THE REGULAR LEM-ON DAP CODING
R1015 4. DENOMINATOR POLES INSIDE THE Z-PLANE UNIT CIRCLE
R1017 5. NUMERATOR ZEROS INSIDE THE Z-PLANE DOUBLE-UNIT CIRCLE
R1019 6. HIGH FREQUENCY (BODE) GAIN LESS THAN 8ASCREVS, OR 8.6380088 DEG/DEG

R1021 THE FILTERS ARE SHOWN IN THE FOLLOWING DIAGRAMS.....
R1023 PITCH GEN3DAP FILTER..



R1047 YAW GEN3DAP FILTER..



P1071 THE IMPLEMENTING EQUATIONS FOR THESE FILTERS ARE AS FOLLOWS.....

	PITCH GEN3DAP....	YAW GEN3DAP....
R1073		
R1075	$NPD = (B+4)\ KPGEN3\ NP0$	$NYD = (B+4)\ KYGEN3\ NY0$
R1077	$NP0 = AP0\ EP \qquad +4(Z-1)\ NP1$	$NY0 = AY0\ EY \qquad +4(Z-1)\ NY1$
R1079	$NY1 = AP1\ EP - BP1\ NP0 + (Z-1)\ NP2$	$NY1 = AY1\ EY - BY1\ NY0 + (Z-1)\ NY2$
R1081	$NP2 = AP2\ EP - BP2\ NP0 + (Z-1)\ NP3$	$NY2 = AY2\ EY - BY2\ NY0 + (Z-1)\ NY3$
R1083	$NP3 = AP3\ EP - BP3\ NP0$	$NY3 = AY3\ EY - BY3\ NY0$

R1085 FILTER INPUTS EP AND EY ARE PICKED UP FROM REGULAR LEM-ON CODING AT ERRBTMP (UPPER WORD ONLY), THUS ARE
R1087 SINGLE PRECISION QUANTITIES SCALED AT B-1 REVS. FILTER OUTPUTS NPD AND NYD ARE LEFT IN DOUBLE PRECISION AT
R1089 CMDTMP, SCALED AT 1 ASCREV, READY FOR OUTPUT PROCESSING VIA REGULAR LEM-ON CODING AT ..P,YOFFSET..
R1091 FOLLOWING OUTPUT PROCESSING, RETURN TO THE GEN3DAP FILTERS IS MADE FOR CALCULATION OF THE REMAINING NODES
R1093 $NP1$ TO $NP3$, OR $NY1$ TO $NY3$. GEN3DAP FILTERS THEN RETURN TO THE LEM-ON CODING AT ..DELBARP,Y.. FOR RESPECTIVE
R1095 OFFSET-TRACKER-FILTER COMPUTATIONS AND COPYCYCLES. NOTE THE EQUIVALENCES...$NP1TMP=J5TMP$, $NP1=J5$,
R1097 $NP2TMP=NSUMTMP$, $NP2=PNSUM$, $NP3TMP=DSUMTMP$, $NP3=PDSUM$, WITH CORRESPONDING RELATIONS FOR YAW. THUS THE COPY-
R1099 CYCLE PCOPY, FROM THE GEN3DAP STANDPOINT, IS EFFECTIVE FROM PMISC-3 TO ITS END AT TC Q. YCOPY FROM YMISC-3.
R1101 SCALING OF THE FILTER NODES, COEFFICIENTS, AND GAINS WITHIN THE AGC IS AS FOLLOWS.....

	QUANTITY	QUANTITY	PHYS.UNITS	MAX.VALUE	SCALE AT (FOR)	
R1103						
R1105	EP	EY	REVS	1/8	B-1 REV	(CDU SCALING)
R1107	$NP0$	$NY0$	REVS	$(B+1)$	B+1 REV	
R1109	$NP1$	$NY1$	REVS	$(B+3)$	B+3 REV	
R1111	$NP2$	$NY2$	REVS	$(B+3)$	B+3 REV	
R1113	$NP3$	$NY3$	REVS	$(B+3)$	B+3 REV	
R1115	NPD	NYD	ASC REVS	(1)	1 ASCREV	(ACTUATOR CDU SCALING)
R1117	$KPGEN3$	$KYGEN3$	ASCREV/REV	(8)	B+3 ASCREV/REV	
R1119	$AP0$	$AY0$	DIMLESS.	1	B+2	
R1121	$AP1$	$AY1$	DIMLESS.	6	B+4	
R1123	$AP2$	$AY2$	DIMLESS.	12	B+4	
R1125	$AP3$	$AY3$	DIMLESS.	8	B+4	
R1127	$BP1$	$BY1$	DIMLESS.	3	B+2	
R1129	$BP2$	$BY2$	DIMLESS.	3	B+2	
R1131	$BP3$	$BY3$	DIMLESS.	1	B+2	

R1132 FILTER COEFFICIENTS, GAINS, AND NODES ARE HELD IN DOUBLE PRECISION (ERASABLE) TO PERMIT CONSERVATIVE
R1134 SCALING AND YET OFFSET TRUNCATION LOSSES. THIS APPEARS NECESSARY IF FILTER FLEXIBILITY IS TO BE MAINTAINED.
R1136 COMPUTATION TIME IS NOT CRITICAL.

L TVCGEN3FILTERS USER=S PAGE NO. 3 E0 S3

```
R1138   CALLING SEQUENCE....

R1139       *TC POSTJUMP....
R1140        CADR NP0NODE, NP1, NY0, NY1.  SPECIFICALLY, FROM PITCHDAP OR YAWDAP
R1141        (TVCDAP),AT P1FILJMP, P2FILJMP, Y1FILJMP, Y2FILJMP

R1142   NORMAL EXIT MODE....

R1143       *TC POSTJUMP....
R1144        CADR  (POFFSET, DELBARP), (YOFFSET, DELBARY).     IE, RETURNS TO
R1145        PITCHDAP OR YAWDAP AT APPROPRIATE ENTRY POINT

R1146   ALARM OR ABORT EXIT MODES....NONE

R1147   SUBROUTINES CALLED.... NONE

R1148   ERASABLE INITIALIZATION REQUIRED....

R1149       *AP0(SP),AP1(DP),...AP3(DP), (PITCH AND YAW) NUMERATOR COEFFICIENTS
R1150        (PAD LOADS)
R1151       *BP1(DP),...BP3(DP), (PITCH AND YAW) DENOMINATOR COEFFICIENTS
R1152        (PAD LOADS)
R1153       *KPGEN3 (S40.15 OF R03)

R1154   OUTPUT....

R1155       *CMDIMP (NPD, NYD) FOR OUTPUT PROCESSING BY PITCHDAP OR YAWDAP
R1156       *OTHER FILTER NODES

R1157   DEBRIS....TVC TEMPORARIES, SHAREABLE WITH RCS/ENTRY IN EBANK6 ONLY
 1158                          21,2026                 BANK   21
 1159   REF   1                17,2000                 SETLOC DAPS4
 1160                          17,2213                 BANK
 1161   REF   1                E6,1742                 EBANK= EP
 1162   REF   1                                        COUNT* $$/GEN3
```

P1163 PITCH GEN3DAP FILTER.....

```
                                17,2213  0 0006 1  NP0NODE  EXTEND                FORM NODE NP0....COLLECT (PAST NP1)
REF   1                         17,2214  3 1564 1           DCA     NP1                 (COMES HERE FROM REG. DAP CODING)
                                17,2215  20 001 1           DDOUBL
                                17,2216  20 001 1           DDOUBL
REF   1                         17,2217  53∝562 0           DXCH    NP0

REF   2  LAST  963              17,2220  31∝742 1  AP0(EP)  CAE     EP            SPXSP MULTIPLY FOR NUMERATOR COMPONENT
                                17,2221  0 0006 1           EXTEND                     EP = ERRBTMP,  SP, SC.AT B-1 REVS
REF   2  LAST   99              17,2222  7 1427 0           MP      AP0
REF   2  LAST  964              17,2223  21∝562 0           DAS     NP0           COMPLETED NODE NP0, SC.AT B+1 REVS
REF   3  LAST  964              17,2224  31∝561 1  NPDNODE  CAE     NP0           FORM NODE NPD....SPXDP MULTIPLY BY GAIN
                                17,2225  0 0006 1           EXTEND
REF   2  LAST  104              17,2226  7 1651 0           MP      KPGEN3
REF   1                         17,2227  53∝745 1           DXCH    NPD
REF   4  LAST  964              17,2230  31∝562 1           CAE     NP0 +1
                                17,2231  0 0006 1           EXTEND
REF   3  LAST  964              17,2232  7 1651 0           MP      KPGEN3
                                17,2233  22 007 0           ZL
REF 218  LAST  956              17,2234  22 000 1           LXCH    A
REF   2  LAST  964              17,2235  21∝745 1           DAS     NPD           SC.AT B+4 ASCREV SINCE KPGEN3 AT B+3

REF   3  LAST  964              17,2236  53∝745 1           DXCH    NPD           FIX UP SCALING
                                17,2237  20 001 1           DDOUBL
                                17,2240  20 001 1           DDOUBL
                                17,2241  20 001 1           DDOUBL
                                17,2242  20 001 1           DDOUBL
REF   4  LAST  964              17,2243  53∝745 1           DXCH    NPD           COMPLETED NODE NPD, SC.AT 1ASCREV
REF  54  LAST  932              17,2244  0 4574 0           TC      POSTJUMP      TRANSFER BACK TO REGULAR DAP CODING FOR
REF   1                         17,2245   40441 1           CADR    POFFSET            OUTPUT  (NPD = CMDTMP, DP)
                                17,2246  0 0006 1  NP1NODE  EXTEND                FORM NODE NP1....COLLECT  (PAST NP2)
REF   1                         17,2247  3 1542 0           DCA     NP2                 (COMES HERE FROM REG. DAP CODING)
REF   1                         17,2250  53∝737 1           DXCH    NP1TMP

REF   5  LAST  964              17,2251  4 1561 0  BP1(NP0) CS      NP0           DPXDP MULTIPLY FOR DENOMINATOR COMPONENT
                                17,2252  0 0006 1           EXTEND
REF   2  LAST   99              17,2253  7 1436 0           MP      BP1
REF   2  LAST  964              17,2254  21∝737 1           DAS     NP1TMP
REF   6  LAST  964              17,2255  4 1562 0           CS      NP0 +1
                                17,2256  0 0006 1           EXTEND
REF   3  LAST  964              17,2257  7 1436 0           MP      BP1
REF   3  LAST  964              17,2260  27∝737 1           ADS     NP1TMP +1
REF 103  LAST  955              17,2261  54 001 1           TS      L
                                17,2262  1 2264 1           TCF     +2
REF   4  LAST  964              17,2263  27∝736 0           ADS     NP1TMP
```

```
1205  REF   7  LAST  964   17,2264  4 1561 0          CS    NP0
1206                       17,2265  0 0006 1          EXTEND
1207  REF   4  LAST  964   17,2266  7 1437 1          MP    BP1 +1
1208  REF   5  LAST  964   17,2267  27«737 1          ADS   NP1TMP +1
1209  REF 104  LAST  964   17,2270  54 001 1          TS    L
1210                       17,2271  1 2273 1          TCF   +2
1211  REF   6  LAST  965   17,2272  27«736 0          ADS   NP1TMP

1212  REF   3  LAST  964   17,2273  31«742 1  AP1(EP)  CAE   EP          DPXSP MULTIPLY FOR NUMERATOR COMPONENT
1213                       17,2274  0 0006 1          EXTEND
1214  REF   2  LAST   99   17,2275  7 1430 0          MP    AP1
1215  REF   7  LAST  965   17,2276  21«737 1          DAS   NP1TMP
1216  REF   4  LAST  965   17,2277  31«742 1          CAE   EP
1217                       17,2300  0 0006 1          EXTEND
1218  REF   3  LAST  965   17,2301  7 1431 1          MP    AP1 +1
1219  REF   8  LAST  965   17,2302  27«737 1          ADS   NP1TMP +1
1220  REF 105  LAST  965   17,2303  54 001 1          TS    L
1221                       17,2304  1 2306 1          TCF   +2
1222  REF   9  LAST  965   17,2305  27«736 0          ADS   NP1TMP      COMPLETED NODE NP1

1223                       17,2306  0 0006 1  NP2NODE  EXTEND          FORM NODE NP2....COLLECT (PAST NP3)
1224  REF   1              17,2307  3 1544 0          DCA   NP3
1225  REF   1              17,2310  53«712 0          DXCH  NP2TMP
1226  REF   8  LAST  965   17,2311  4 1561 0  BP2(NP0) CS    NP0         DPXDP MULTIPLY FOR DENOMINATOR COMPONENT
1227                       17,2312  0 0006 1          EXTEND
1228  REF   2  LAST  100   17,2313  7 1440 1          MP    BP2
1229  REF   2  LAST  965   17,2314  21«712 0          DAS   NP2TMP
1230  REF   9  LAST  965   17,2315  4 1562 0          CS    NP0 +1
1231                       17,2316  0 0006 1          EXTEND
1232  REF   3  LAST  965   17,2317  7 1440 1          MP    BP2
1233  REF   3  LAST  965   17,2320  27«712 0          ADS   NP2TMP +1
1234  REF 106  LAST  965   17,2321  54 001 1          TS    L
1235                       17,2322  1 2324 1          TCF   +2
1236  REF   4  LAST  965   17,2323  27«711 0          ADS   NP2TMP
1237  REF  10  LAST  965   17,2324  4 1561 0          CS    NP0
1238                       17,2325  0 0006 1          EXTEND
1239  REF   4  LAST  965   17,2326  7 1441 0          MP    BP2 +1
1240  REF   5  LAST  965   17,2327  27«712 0          ADS   NP2TMP +1
1241  REF 107  LAST  965   17,2330  54 001 1          TS    L
1242                       17,2331  1 2333 1          TCF   +2
1243  REF   6  LAST  965   17,2332  27«711 0          ADS   NP2TMP

1244  REF   5  LAST  965   17,2333  31«742 1  AP2(EP)  CAE   EP          DPXSP MULTIPLY FOR NUMERATOR COMPONENT
1245                       17,2334  0 0006 1          EXTEND
1246  REF   2  LAST   99   17,2335  7 1432 1          MP    AP2
1247  REF   7  LAST  965   17,2336  21«712 0          DAS   NP2TMP
1248  REF   6  LAST  965   17,2337  31«742 1          CAE   EP
1249                       17,2340  0 0006 1          EXTEND
1250  REF   3  LAST  965   17,2341  7 1433 0          MP    AP2 +1
1251  REF   8  LAST  965   17,2342  27«712 0          ADS   NP2TMP +1
```

```
1252  REF 108  LAST  965   17,2343  54 001 1          TS     L
1253                       17,2344  1 2346 0          TCF    +2
1254  REF   9  LAST  965   17,2345  27=711 0          ADS    NP2TMP        COMPLETED NODE NP2

1255  REF  11  LAST  965   17,2346  4 1561 0  NP3NODE CS     NP0           FORM NODE NP3....NO PAST NODES, DIRECT
1256                       17,2347  0 0006 1          EXTEND                 TO DPXDP MULTIPLY FOR DENOMINATOR
1257  REF   2  LAST  100   17,2350  7 1442 0          MP     BP3            COMPONENT
1258  REF   1               17,2351  53=714 0          DXCH   NP3TMP
1259  REF  12  LAST  966   17,2352  4 1562 0          CS     NP0 +1
1260                       17,2353  0 0006 1          EXTEND
1261  REF   3  LAST  966   17,2354  7 1442 0          MP     BP3
1262  REF   2  LAST  966   17,2355  27=714 0          ADS    NP3TMP +1
1263  REF 109  LAST  966   17,2356  54 001 1          TS     L
1264                       17,2357  1 2361 0          TCF    +2
1265  REF   3  LAST  966   17,2360  27=713 1          ADS    NP3TMP
1266  REF  13  LAST  966   17,2361  4 1561 0          CS     NP0
1267                       17,2362  0 0006 1          EXTEND
1268  REF   4  LAST  966   17,2363  7 1443 1          MP     BP3 +1
1269  REF   4  LAST  966   17,2364  27=714 0          ADS    NP3TMP +1
1270  REF 110  LAST  966   17,2365  54 001 1          TS     L
1271                       17,2366  1 2370 0          TCF    +2
1272  REF   5  LAST  966   17,2367  27=713 1          ADS    NP3TMP

1273  REF   7  LAST  965   17,2370  31=742 1  AP3(EP) CAE    EP            DPXSP MULTIPLY FOR NUMERATOR COMPONENT
1274                       17,2371  0 0006 1          EXTEND
1275  REF   2  LAST   99   17,2372  7 1434 1          MP     AP3
1276  REF   6  LAST  966   17,2373  21=714 0          DAS    NP3TMP
1277  REF   8  LAST  966   17,2374  31=742 1          CAE    EP
1278                       17,2375  0 0006 1          EXTEND
1279  REF   3  LAST  966   17,2376  7 1435 0          MP     AP3 +1
1280  REF   7  LAST  966   17,2377  27=714 0          ADS    NP3TMP +1
1281  REF 111  LAST  966   17,2400  54 001 1          TS     L
1282                       17,2401  1 2403 0          TCF    +2
1283  REF   8  LAST  966   17,2402  27=713 1          ADS    NP3TMP        COMPLETED NODE NP3, AND PITCH GEN3DAP
A1284                                                                        FILTER COMPUTATIONS
1285  REF  55  LAST  964   17,2403  0 4574 0          TC     POSTJUMP      RETURN TO CSMDAP CODING FOR PITCH
1286  REF   1               17,2404   40526 1          CADR   DELBARP         OFFSET-TRACKER-FILTER COMPUTATIONS,
A1287                                                                       AND PITCH DAP COPYCYCLE.
```

P1288 YAW GEN3DAP FILTER....

```
1289                        17,2405  0 0006 1  NY0NODE  EXTEND          FORM NODE NY0....COLLECT  (PAST NY1)
1290  REF   1               17,2406  3 1610 1           DCA     NY1          (COMES HERE FROM REG. DAP CODING)
1291                        17,2407  20 001 1           DDOUBL
1292                        17,2410  20 001 1           DDOUBL
1293  REF   1               17,2411  53=606 1           DXCH    NY0

1294  REF   1               17,2412  31=742 1  AY0(EY)  CAE     EY           SPXSP MULTIPLY FOR NUMERATOR COMPONENT
1295                        17,2413  0 0006 1           EXTEND                  EY = ERRBTMP,  SP, SC.AT B-1 REVS
1296  REF   1               17,2414  7 1427 0           MP      AY0
1297  REF   2  LAST  967    17,2415  21=606 1           DAS     NY0          COMPLETED NODE NY0, SC.AT B+1 REVS
1298  REF   3  LAST  967    17,2416  31=605 0  NYDNODE  CAE     NY0          FORM NODE NYD....SPXDP MULTIPLY BY GAIN
1299                        17,2417  0 0006 1           EXTEND
1300  REF   1               17,2420  7 1651 0           MP      KYGEN3
1301  REF   1               17,2421  53=745 1           DXCH    NYD
1302  REF   4  LAST  967    17,2422  31=606 0           CAE     NY0 +1
1303                        17,2423  0 0006 1           EXTEND
1304  REF   2  LAST  967    17,2424  7 1651 0           MP      KYGEN3
1305                        17,2425  22 007 0           ZL
1306  REF 219  LAST  964    17,2426  22 000 1           LXCH    A
1307  REF   2  LAST  967    17,2427  21=745 1           DAS     NYD          SC.AT B+4 ASCREV SINCE KYGEN3 AT B+1

1308  REF   3  LAST  967    17,2430  53=745 1           DXCH    NYD          FIX UP SCALING
1309                        17,2431  20 001 1           DDOUBL
1310                        17,2432  20 001 1           DDOUBL
1311                        17,2433  20 001 1           DDOUBL
1312                        17,2434  20 001 1           DDOUBL
1313  REF   4  LAST  967    17,2435  53=745 1           DXCH    NYD          COMPLETED NODE NYD, SC.AT 1ASCREV
1314  REF  56  LAST  966    17,2436  0 4574 0           TC      POSTJUMP     TRANSFER BACK TO REGULAR DAP CODING FOR
1315  REF   1               17,2437   40730 1          CADR    YOFFSET         OUTPUT  (NYD = CMDTMP, DP)
1316                        17,2440  0 0006 1  NY1NODE  EXTEND          FORM NODE NY1....COLLECT  (PAST NY2)
1317  REF   1               17,2441  3 1566 0           DCA     NY2          (COMES HERE FROM REG. DAP CODING)
1318  REF   1               17,2442  53=737 1           DXCH    NY1TMP

1319  REF   5  LAST  967    17,2443  4 1605 1  BY1(NY0) CS      NY0          DPXDP MULTIPLY FOR DENOMINATOR COMPONENT
1320                        17,2444  0 0006 1           EXTEND
1321  REF   1               17,2445  7 1436 0           MP      BY1
1322  REF   2  LAST  967    17,2446  21=737 1           DAS     NY1TMP
1323  REF   6  LAST  967    17,2447  4 1606 1           CS      NY0 +1
1324                        17,2450  0 0006 1           EXTEND
1325  REF   2  LAST  967    17,2451  7 1436 0           MP      BY1
1326  REF   3  LAST  967    17,2452  27=737 1           ADS     NY1TMP +1
1327  REF 112  LAST  966    17,2453  54 001 1           TS      L
1328                        17,2454  1 2456 0           TCF     +2
1329  REF   4  LAST  967    17,2455  27=736 0           ADS     NY1TMP
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1330  REP  7  LAST  967   17,2456  4 1605 1          CS    NY0
1331                      17,2457  0 0006 1          EXTEND
1332  REP  3  LAST  967   17,2460  7 1437 1          MP    BY1 +1
1333  REP  5  LAST  967   17,2461  27∝737 1          ADS   NY1TMP +1
1334  REP 113  LAST  967   17,2462  54 001 1          TS    L
1335                      17,2463  1 2465 0          TCF   +2
1336  REP  6  LAST  968   17,2464  27∝736 0          ADS   NY1TMP

1337  REP  2  LAST  967   17,2465  31∝742 1  AY1(EY)  CAE   EY          DPXSP MULTIPLY FOR NUMERATOR COMPONENT
1338                      17,2466  0 0006 1          EXTEND
1339  REP  1              17,2467  7 1430 0          MP    AY1
1340  REP  7  LAST  968   17,2470  21∝737 1          DAS   NY1TMP
1341  REP  3  LAST  968   17,2471  31∝742 1          CAE   EY
1342                      17,2472  0 0006 1          EXTEND
1343  REP  2  LAST  968   17,2473  7 1431 1          MP    AY1 +1
1344  REP  8  LAST  968   17,2474  27∝737 1          ADS   NY1TMP +1
1345  REP 114  LAST  968   17,2475  54 001 1          TS    L
1346                      17,2476  1 2500 1          TCF   +2
1347  REP  9  LAST  968   17,2477  27∝736 0          ADS   NY1TMP       COMPLETED NODE NY1

1348                      17,2500  0 0006 1  NY2NODE  EXTEND            FORM NODE NY2....COLLECT (PAST NY3)
1349  REP  1              17,2501  3 1570 1          DCA   NY3
1350  REP  1              17,2502  53∝712 0          DXCH  NY2TMP

1351  REP  8  LAST  968   17,2503  4 1605 1  BY2(NY0) CS    NY0         DPXDP MULTIPLY FOR DENOMINATOR COMPONENT
1352                      17,2504  0 0006 1          EXTEND
1353  REP  1              17,2505  7 1440 1          MP    BY2
1354  REP  2  LAST  968   17,2506  21∝712 0          DAS   NY2TMP
1355  REP  9  LAST  968   17,2507  4 1606 1          CS    NY0 +1
1356                      17,2510  0 0006 1          EXTEND
1357  REP  2  LAST  968   17,2511  7 1440 1          MP    BY2
1358  REP  3  LAST  968   17,2512  27∝712 0          ADS   NY2TMP +1
1359  REP 115  LAST  968   17,2513  54 001 1          TS    L
1360                      17,2514  1 2516 0          TCF   +2
1361  REP  4  LAST  968   17,2515  27∝711 0          ADS   NY2TMP
1362  REP 10  LAST  968   17,2516  4 1605 1          CS    NY0
1363                      17,2517  0 0006 1          EXTEND
1364  REP  3  LAST  968   17,2520  7 1441 0          MP    BY2 +1
1365  REP  5  LAST  968   17,2521  27∝712 0          ADS   NY2TMP +1
1366  REP 116  LAST  968   17,2522  54 001 1          TS    L
1367                      17,2523  1 2525 0          TCF   +2
1368  REP  6  LAST  968   17,2524  27∝711 0          ADS   NY2TMP

1369  REP  4  LAST  968   17,2525  31∝742 1  AY2(EY)  CAE   EY          DPXSP MULTIPLY FOR NUMERATOR COMPONENT
1370                      17,2526  0 0006 1          EXTEND
1371  REP  1              17,2527  7 1432 1          MP    AY2
1372  REP  7  LAST  968   17,2530  21∝712 0          DAS   NY2TMP
1373  REP  5  LAST  968   17,2531  31∝742 1          CAE   EY
1374                      17,2532  0 0006 1          EXTEND
1375  REP  2  LAST  968   17,2533  7 1433 0          MP    AY2 +1
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1376  REF   8  LAST  968   17,2534  27"712 0          ADS   NY2TMP +1
1377  REF 117  LAST  968   17,2535  54 001 1          TS    L
1378                       17,2536  1 2540 0          TCF   +2
1379  REF   9  LAST  969   17,2537  27"711 0          ADS   NY2TMP        COMPLETED NODE NY2

1380  REF  11  LAST  968   17,2540  4 1605 1  NY3NODE CS    NY0           FORM NODE NY3....NO PAST NODES, DIRECT
1381                       17,2541  0 0006 1          EXTEND                   TO DPXDP MULTIPLY FOR DENOMINATOR
1382  REF   1              17,2542  7 1442 0          MP    BY3                COMPONENT
1383  REF   1              17,2543  53"714 0          DXCH  NY3TMP
1384  REF  12  LAST  969   17,2544  4 1606 1          CS    NY0 +1
1385                       17,2545  0 0006 1          EXTEND
1386  REF   2  LAST  969   17,2546  7 1442 0          MP    BY3
1387  REF   2  LAST  969   17,2547  27"714 0          ADS   NY3TMP +1
1388  REF 118  LAST  969   17,2550  54 001 1          TS    L
1389                       17,2551  1 2553 1          TCF   +2
1390  REF   3  LAST  969   17,2552  27"713 1          ADS   NY3TMP
1391  REF  13  LAST  969   17,2553  4 1605 1          CS    NY0
1392                       17,2554  0 0006 1          EXTEND
1393  REF   3  LAST  969   17,2555  7 1443 1          MP    BY3 +1
1394  REF   4  LAST  969   17,2556  27"714 0          ADS   NY3TMP +1
1395  REF 119  LAST  969   17,2557  54 001 1          TS    L
1396                       17,2560  1 2562 0          TCF   +2
1397  REF   5  LAST  969   17,2561  27"713 1          ADS   NY3TMP

1398  REF   6  LAST  968   17,2562  31"742 1  AY3(EY) CAE   EY            DPXSP MULTIPLY FOR NUMERATOR COMPONENT
1399                       17,2563  0 0006 1          EXTEND
1400  REF   1              17,2564  7 1434 1          MP    AY3
1401  REF   6  LAST  969   17,2565  21"714 0          DAS   NY3TMP
1402  REF   7  LAST  969   17,2566  31"742 1          CAE   EY
1403                       17,2567  0 0006 1          EXTEND
1404  REF   2  LAST  969   17,2570  7 1435 0          MP    AY3 +1
1405  REF   7  LAST  969   17,2571  27"714 0          ADS   NY3TMP +1
1406  REF 120  LAST  969   17,2572  54 001 1          TS    L
1407                       17,2573  1 2575 0          TCF   +2
1408  REF   8  LAST  969   17,2574  27"713 1          ADS   NY3TMP        COMPLETED NODE NY3, AND YAW GEN3DAP
A1409                                                                        FILTER COMPUTATIONS
1410  REF  57  LAST  967   17,2575  0 4574 0          TC    POSTJUMP      RETURN TO CSMDAP CODING FOR YAW
1411  REF   1              17,2576   41015 0          CADR  DELBARY              OFFSET-TRACKER-FILTER COMPUTATIONS,
A1412                                                                        AND YAW DAP COPYCYCLE.
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0001                          20,3565                    BANK   20
0002  REF   1                 21,2000                    SETLOC MYSUBS
0003                          21,2026                    BANK

0004  REF   3  LAST  202      E6,1510                    EBANK= KMPAC
0005  REF   1                    4767          SPCOS1    EQUALS SPCOS
0006  REF   1                    4770          SPSIN1    EQUALS SPSIN
0007  REF   2  LAST  970         4767          SPCOS2    EQUALS SPCOS
0008  REF   2  LAST  970         4770          SPSIN2    EQUALS SPSIN
0009  REF   1                                            COUNT  21/DAPMS

R0010  ONE AND ONE HALF PRECISION MULTIPLICATION ROUTINE

0011  REF   2  LAST  106      21,2026  55∝512 1  SMALLMP  TS     KMPTEMP        A(X+Y)
0012                          21,2027  0 0006 1           EXTEND
0013  REF   4  LAST  970      21,2030  7 1511 1           MP     KMPAC +1
0014  REF   5  LAST  970      21,2031  55∝511 1           TS     KMPAC +1       AY
0015  REF 172  LAST  959      21,2032  3 4714 1           CAF    ZERO
0016  REF   6  LAST  970      21,2033  57∝510 1           XCH    KMPAC
0017                          21,2034  0 0006 1           EXTEND
0018  REF   3  LAST  970      21,2035  7 1512 1           MP     KMPTEMP        AX
0019  REF   7  LAST  970      21,2036  21∝511 1           DAS    KMPAC          AX+AY
0020  REF 189  LAST  945      21,2037  0 0002 0           TC     Q
R0021  SUBROUTINE FOR DOUBLE PRECISION ADDITIONS OF ANGLES
R0022  A AND L CONTAIN A DP(1S) ANGLE SCALED BY 180 DEGS TO BE ADDED TO KMPAC.
R0023  RESULT IS PLACED IN KMPAC.  TIMING = 6 MCT (22 MCT ON OVERFLOW)

0024  REF   8  LAST  970      21,2040  21∝511 1  DPADD    DAS    KMPAC
0025                          21,2041  0 0006 1           EXTEND
0026  REF   1                 21,2042  1 2057 0           BZF    TSK +1         NO OVERFLOW
0027  REF   9  LAST  970      21,2043  11∝510 0           CCS    KMPAC
0028  REF   1                 21,2044  1 2060 1           TCF    DPADD+         + OVERFLOW
0029                          21,2045  1 2047 1           TCF    +2
0030  REF   1                 21,2046  1 2062 0           TCF    DPADD-         - OVERFLOW
0031  REF  10  LAST  970      21,2047  11∝511 1           CCS    KMPAC +1
0032  REF   1                 21,2050  1 2065 1           TCF    DPADD2+        UPPER = 0, LOWER +
0033                          21,2051  1 2053 1           TCF    +2
0034                          21,2052  4 0000 0           COM                   UPPER = 0, LOWER -
0035  REF  22  LAST  957      21,2053  6 4672 0           AD     POSMAX         LOWER = 0, A=0
0036  REF  11  LAST  970      21,2054  55∝511 1           TS     KMPAC +1       CAN NOT OVERFLOW
0037  REF  23  LAST  970      21,2055  3 4672 0           CA     POSMAX         UPPER WAS = 0
0038  REF  12  LAST  970      21,2056  55∝510 0  TSK      TS     KMPAC
0039  REF 190  LAST  970      21,2057  0 0002 0           TC     Q

0040  REF   5  LAST  957      21,2060  6 4674 0  DPADD+   AD     NEGMAX         KMPAC GREATER THAN 0
0041  REF   2  LAST  970      21,2061  1 2056 1           TCF    TSK
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0042                        21,2062  4 0000 0  DPADD-   COM
0043   REF  24  LAST  970   21,2063  6 4672 0           AD     POSMAX     KMPAC LESS THAN 0
0044   REF   3  LAST  970   21,2064  1 2056 1           TCF    TSK

0045   REF   6  LAST  970   21,2065  6 4674 0  DPADD2+  AD     NEGMAX     CAN NOT OVERFLOW
0046   REF  13  LAST  970   21,2066 55=511 1           TS     KMPAC +1
0047   REF   7  LAST  971   21,2067  3 4674 0           CA     NEGMAX     UPPER WAS = 0
0048   REF   4  LAST  971   21,2070  1 2056 1           TCF    TSK
```

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L       RCS-CSM DIGITAL AUTOPILOT                                                    USER∝S PAGE NO.   1      E0 S3

P0001   T5 INTERRUPT PROGRAM FOR THE RCS-CSM AUTOPILOT
R0002        START OF T5 INTERRUPT PROGRAM
 0003                          20,3565                          BANK   20
 0004   REF   2  LAST  691    21,2000                          SETLOC DAPS3
 0005                          21,2071                          BANK

 0006   REF   1                                                COUNT  21/DAPRC

 0007   REF  14  LAST  971    E6,1510                          EBANK= KMPAC
 0008   REF  16  LAST  959    21,2071  22 016 0  REDORCS      LXCH   BANKRUPT      RESTART OF AUTOPILOT COMES HERE
 0009   REF   2  LAST  692    21,2072  3 1465 1               CA     T5PHASE       ON A T5 RUPT.
 0010                          21,2073  0 0006 1               EXTEND
 00101                         21,2074  6 2076 1               BZMF   +2            IF T5PHASE +0, -0, OR -, RESET TO -
 00102                         21,2075  1 2100 0               TCF    +3            IF T5PHASE +, LEAVE IT +.  DO A FRESHDAP
 00103  REF 102  LAST  956    21,2076  4 4712 0               CS     ONE
 00104  REF   3  LAST  973    21,2077  55∝465 0               TS     T5PHASE
 0011                          21,2100  0 0006 1               EXTEND
 0012   REF   1                21,2101  3 2105 1               DCA    RCSLOC
 0013   REF  19  LAST  936    21,2102  53∝313 0               DXCH   T5LOC         HOOK UP T5RUPT TO AUTOPILOT
 0014   REF   3  LAST  692    21,2103  1 2107 1               TCF    RCSATT +1
 0015   REF  15  LAST  973    E6,1510                          EBANK= KMPAC
 0016   REF   4  LAST  973    21,2104   02106 1  RCSLOC       2CADR  RCSATT
 0016                          21,2105   42066 1
 0017   REF  17  LAST  973    21,2106  22 016 0  RCSATT       LXCH   BANKRUPT      SAVE BB
 0018                          21,2107  0 0006 1               EXTEND               SAVE Q
 0019   REF  13  LAST  930    21,2110  22 012 1               QXCH   QRUPT
 0020   REF  40  LAST  958    21,2111  3 4674 0               CAF    BIT15         BIT15 CHAN31 = 0 IF IMU POWER IS ON AND
 0021                          21,2112  0 0006 1               EXTEND               S/C CONT SW IS IN CMC (I.E. IF G/C AUTO
 0022   REF   5  LAST  682    21,2113  02 031 1               RAND   CHAN31        PILOT IS FULLY ENABLED)
 0023                          21,2114  0 0006 1               EXTEND
 0024   REF   1                21,2115  1 2144 0               BZF    SETT5         IF G/C AUTOPILOT IS FULLY ENABLED,
A0025                                                                              GO TO SETT5

 0026   REF  14  LAST  901    21,2116  4 1501 0               CS     RCSFLAGS      IF G/C AUTOPILOT IS NOT FULLY ENABLED,
 0027   REF  51  LAST  953    21,2117  7 4675 0               MASK   BIT14
 0028   REF  15  LAST  973    21,2120  27∝501 0               ADS    RCSFLAGS      SET NORATE FLAG,
 0029   REF  25  LAST  971    21,2121  3 4672 0               CAF    POSMAX
 0030   REF   7  LAST  690    21,2122  55∝332 0               TS     HOLDFLAG      SET HOLDFLAG +,
 00301  REF 173  LAST  970    21,2123  3 4714 1               CAF    ZERO          ZERO ERRORX, ERRORY, AND ERRORZ,
 00302  REF   5  LAST  173    21,2124  55∝567 0               TS     ERRORX
 00303  REF   3  LAST  111    21,2125  55∝570 0               TS     ERRORY
 00304  REF   2  LAST  107    21,2126  55∝571 1               TS     ERRORZ
 0031   REF  52  LAST  973    21,2127  3 4675 1               CAF    BIT14
 0032                          21,2130  0 0006 1               EXTEND
 0033   REF   6  LAST  973    21,2131  02 031 1               RAND   CHAN31        AND CHECK FREE FUNCTION (BIT14 CHAN31).
 003309                        21,2132  0 0006 1               EXTEND
```

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 00331  REF   2  LAST  973   21,2133  1 2144 0          BZF    SETT5          IF IN FREE MODE, GO TO SETT5.

 00332  REF   4  LAST  973   21,2134  55=465 0          TS     T5PHASE        IF NOT IN FREE MODE,
 00333  REF   1               21,2135  3 7676 1          CAF    OCT37766       SCHEDULE REINITIALIZATION (FRESHDAP)
 00334  REF  15  LAST  936   21,2136  54 030 0          TS     TIME5          IN 100 MS VIA T5RUPT

 00335  REF   3  LAST  690   21,2137  0 2616 1          TCR    ZEROJET        ZERO JET CHANNELS IN 14 MS VIA ZEROJET

 0034   REF   1               21,2140  1 2334 0          TCF    KMATRIX
 0035                         21,2141   37770 0 DELTATT  OCT    37770          80MS (TIME5)
 0036                         21,2142   37776 0 DELTATT2 OCT    37776          20MS (TIME5)
 0037                         21,2143   37634 1 ONESEK   DEC    16284          1 SEC(TIME5)
 0038                            0005         CHAN5    EQUALS 5
 0039                            0006         CHAN6    EQUALS 6
 0043   REF   4  LAST  227      7671         PRIO34A  =      PRIO34
R0044           CHECK PHASE OF T5 PROGRAM

R0045       BECAUSE OF THE LENGTH OF THE T5 PROGRAM, IT HAS BEEN DIVIDED INTO
R0046   THREE PARTS, T5PHASE1, T5PHASE2, AND THE JET SELECTION LOGIC,
R0047   TO ALLOW FOR THE EXECUTION OF OTHER
R0048   INTERRUPTS.  T5PHASE IS ALSO USED IN THE INITIALIZATION OF THE AUTOPILOT
R0049   VARIABLES AT TURN ON.
R0050   THE CODING OF T5PHASE IS...

R0051                + = INITIALIZE T5 RCS-CSM AUTOPILOT
R0052   T5PHASE = +0 = PHASE2 OF THE T5 PROGRAM
R0053             - = RESTART DAP
R0054            -0 = PHASE1 OF THE T5 PROGRAM

 0055   REF   5  LAST  974   21,2144  11=465 0  SETT5    CCS    T5PHASE
 0056   REF   1               21,2145  1 2530 1          TCF    FRESHDAP       TURN ON AUTOPILOT
 0057   REF   1               21,2146  1 2645 0          TCF    T5PHASE2       BRANCH TO PHASE2 OF PROGRAM
 0058   REF   1               21,2147  1 2532 0          TCF    REDAP          RESTART AUTOPILOT
 0059   REF   6  LAST  974   21,2150  55=465 0          TS     T5PHASE        PHASE 1  RESET  FOR PHASE 2
 0060   REF  16  LAST  974   21,2151  3 0030 1          CA     TIME5
 0061   REF   2  LAST  107   21,2152  55=634 0          TS     T5TIME         USED IN COMPENSATING FOR DELAYS IN T5
 0062   REF   1               21,2153  3 2142 1          CAF    DELTATT2       RESET FOR T5RUPT IN 20MS FOR PHASE2
 0063   REF  17  LAST  974   21,2154  54 030 0          TS     TIME5          OF PROGRAM
```

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P0064   IMU STATUS CHECK

 0065   REF  26  LAST  381   21,2155  4 1321 1          CS     IMODES33     CHECK IMU STATUS
 0066   REF  36  LAST  777   21,2156  7 4705 0          MASK   BIT6         BIT6 = 0  IMU OK
 0067   REF 220  LAST  967   21,2157  10 000 0          CCS    A            BIT6 = 1 NO IMU
 0068   REF   1              21,2160  1 2174 0          TCF    RATEFILT
 0069   REF  16  LAST  973   21,2161  4 1501 0  FREECHK  CS     RCSFLAGS     BIT14 INDICATES THAT RATES HAVE NOT BEEN
 0070   REF  53  LAST  973   21,2162  7 4675 0          MASK   BIT14        INITIALIZED
 0071   REF  17  LAST  975   21,2163  27∝501 0          ADS    RCSFLAGS
 0072   REF  54  LAST  975   21,2164  3 4675 1          CAF    BIT14        NO ATTITUDE REFERENCE
 0073   REF   8  LAST  973   21,2165  55∝332 0          TS     HOLDFLAG     STOP ANY AUTOMATIC STEERING AND PREPARE
A0074                                                                       TO PICK UP CDU ANGLES UPON RESUMPTION OF
A0075                                                                       ATTITUDE HOLD
 0076                         21,2166  0 0006 1          EXTEND
 0077   REF   7  LAST  973   21,2167  02 031 1          RAND   CHAN31       CHECK FOR FREE MODE
 0078                         21,2170  0 0006 1          EXTEND
 0079   REF   1              21,2171  1 2403 0          BZF    KRESUME1     IN FREE MODE PROVIDE FREE CONTROL ONLY
 0080   REF   1              21,2172  1 2520 0          TCF    REINIT       .....TILT.............................
 0081                         21,2173   00030 1  BITS4,5  OCT    30
 0082   REF  18  LAST  975   21,2174  3 1501 1  RATEFILT CA     RCSFLAGS     SEE IF RATEFILTER HAS BEEN INITIALIZED
 0083   REF  55  LAST  975   21,2175  7 4675 0          MASK   BIT14
 0084                         21,2176  0 0006 1          EXTEND              IF SO, PROCEED WITH RATE DERIVATION
 0085                         21,2177  1 2201 1          BZF    +2
 0086   REF   2  LAST  974   21,2200  1 2334 0          TCF    KMATRIX      IF NOT, SKIP RATE DERIVATION

R0087            RATE FILTER     TIMING = 7.72MS

R0088   RATE FILTER EQUATIONS
R0089   DRHO = DELRHO - (.1)ADOT + (1 - GAIN1)DRHO
R0090                                          -1
R0091   ADOT = ADOT    + GAIN2 DRHO + KMJ DFT
R0092              -1
R0093         -        *     -     -
R0094   WHERE DELRHO = AMGB (CDU - CDU  )
R0095                                -1

 0096   REF  38  LAST  905   21,2201  3 4711 1          CAF    TWO
 0097   REF   3  LAST  110   21,2202  55∝506 1  DRHOLOOP TS     SPNDX
 0098                         21,2203  6 0000 1          DOUBLE
 0099   REF   2  LAST  106   21,2204  55∝507 0          TS     DPNDX
 0100   REF   3  LAST  975   21,2205  51∝507 1          INDEX  DPNDX
 0101   REF   2  LAST  106   21,2206  4 1552 0          CS     DRHO         DRHO SCALED 180 DEGS
 0102                         21,2207  0 0006 1          EXTEND
 0103   REF   2  LAST  107   21,2210  5 1617 0          INDEX  ATTKALMN     PICK UP DESIRED FILTER GAIN
 0104   REF   1              21,2211  7 3063 0          MP     GAIN1
 0105   REF   4  LAST  975   21,2212  51∝507 1          INDEX  DPNDX
 0106   REF   3  LAST  975   21,2213  21∝553 1          DAS    DRHO         (1 -.064)DRHO
 0107                         21,2214  0 0006 1          EXTEND
```

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 0108   REP   5  LAST  975   21,2215  5 1507 1        INDEX  DPNDX
 0109   REP   6  LAST  168   21,2216  4 1534 0        DCS    ADOT
 0110   REP  16  LAST  973   21,2217  53≠511 1        DXCH   KMPAC      -(.1)ADOT
 0111   REP   2  LAST  280   21,2220  3 4676 1        CA     QUARTER
 0112   REP   1               21,2221  0 2026 1        TC     SMALLMP
 0113   REP  17  LAST  976   21,2222  53≠511 1        DXCH   KMPAC
 0114   REP   6  LAST  976   21,2223  51≠507 1        INDEX  DPNDX
 0115   REP   4  LAST  975   21,2224  21≠553 1        DAS    DRHO
 0116   REP   4  LAST  975   21,2225  11≠506 1        CCS    SPNDX
 0117   REP   1               21,2226  1 2202 1        TCF    DRHOLOOP

 0118   REP  20  LAST  904   21,2227  3 0032 0        CA     CDUX       MEASURED BODY RATES--
 0119   REP   2  LAST  107   21,2230  57≠635 0        XCH    RHO
 0120                        21,2231  0 0006 1        EXTEND
 0121   REP   3  LAST  976   21,2232  21≠635 1        MSU    RHO        -      *    -    -
 0122                        21,2233  4 0000 0        COM                DELRHO = AMGB (CDU - CDU  )
A0123                                                                                    -1
 0124                        21,2234  22 007 0        ZL
 01241  REP   2  LAST  106   21,2235  53≠516 0        DXCH   DELTEMPX
 0125   REP  11  LAST  936   21,2236  3 0033 1        CA     CDUY
 0126   REP   2  LAST  107   21,2237  57≠636 0        XCH    RHO1
 0127                        21,2240  0 0006 1        EXTEND
 0128   REP   3  LAST  976   21,2241  21≠636 1        MSU    RHO1
 0129                        21,2242  4 0000 0        COM
 0130   REP   1               21,2243  55≠502 0        TS     T5TEMP     (CDUY - RHO1)    SCALED 90 DEGS
 0131                        21,2244  0 0006 1        EXTEND
 0132   REP   2  LAST  107   21,2245  7 1640 0        MP     AMGB1
 0133   REP   3  LAST  976   21,2246  21≠516 0        DAS    DELTEMPX   DELTEMPX = (CDUX-RHO) + AMGB1(CDUY-RHO1)
A0134                                                                    MUST BE DOUBLE PRECISION OR WILL LOSE
A0135                                                                    PULSES
 0136   REP   2  LAST  108   21,2247  3 1641 0        CA     AMGB4
 0137                        21,2250  0 0006 1        EXTEND
 0138   REP   2  LAST  976   21,2251  7 1502 0        MP     T5TEMP
 0139   REP   2  LAST  106   21,2252  53≠520 0        DXCH   DELTEMPY
 0140   REP   2  LAST  108   21,2253  3 1643 1        CA     AMGB7
 0141                        21,2254  0 0006 1        EXTEND
 0142   REP   3  LAST  976   21,2255  7 1502 0        MP     T5TEMP
 0143   REP   1               21,2256  53≠522 1        DXCH   DELTEMPZ
 0144   REP  14  LAST  936   21,2257  3 0034 0        CA     CDUZ
 0145   REP   2  LAST  107   21,2260  57≠637 1        XCH    RHO2
 0146                        21,2261  0 0006 1        EXTEND
 0147   REP   3  LAST  976   21,2262  21≠637 0        MSU    RHO2
 0148                        21,2263  4 0000 0        COM
 0149   REP   4  LAST  976   21,2264  55≠502 0        TS     T5TEMP     (CDUZ - RHO2)    SCALED 90 DEGS
 0150                        21,2265  0 0006 1        EXTEND
 0151   REP   2  LAST  108   21,2266  7 1642 1        MP     AMGB5
 0152   REP   3  LAST  976   21,2267  21≠520 0        DAS    DELTEMPY   DELTEMPY =AMGB4(CDUY-RHO1)
A01521                                                                           + AMGB5(CDUZ-RHO2)
 0153   REP   2  LAST  108   21,2270  3 1644 0        CA     AMGB8
 0154                        21,2271  0 0006 1        EXTEND
```

```
0155  REF   5  LAST  976   21,2272  7 1502 0          MP     T5TEMP
0156  REF   2  LAST  976   21,2273  21∝522 1          DAS    DELTEMPZ      DELTEMPZ =AMGB7(CDUY-RHO1)
A01561                                                                                 + AMGB8(CDUZ-RHO2)
0157  REF  39  LAST  975   21,2274  3 4711 1          CAF    TWO
0158  REF   5  LAST  976   21,2275  55∝506 1  ADOTLOOP TS     SPNDX
0159                       21,2276  6 0000 1          DOUBLE
0160  REF   7  LAST  976   21,2277  55∝507 0          TS     DPNDX
01601                      21,2300  0 0006 1          EXTEND
01602 REF   8  LAST  977   21,2301  5 1507 1          INDEX  DPNDX
01603 REF   4  LAST  976   21,2302  3 1516 1          DCA    DELTEMPX
01604 REF   9  LAST  977   21,2303  51∝507 1          INDEX  DPNDX
01605 REF   5  LAST  976   21,2304  21∝553 1          DAS    DRHO
01606                      21,2305  0 0006 1          EXTEND
01607 REF  10  LAST  977   21,2306  5 1507 1          INDEX  DPNDX
01608 REF   5  LAST  977   21,2307  3 1516 1          DCA    DELTEMPX
01609 REF  11  LAST  977   21,2310  51∝507 1          INDEX  DPNDX
016091 REF   2  LAST  106   21,2311  21∝542 1          DAS    MERRORX
0161  REF  12  LAST  977   21,2312  51∝507 1          INDEX  DPNDX
0162  REF   6  LAST  977   21,2313  3 1552 1          CA     DRHO
0163                       21,2314  6 0000 1          DOUBLE                N.B.
0164                       21,2315  6 0000 1          DOUBLE                N.B.
0165                       21,2316  0 0006 1          EXTEND
0166  REF   3  LAST  975   21,2317  5 1617 0          INDEX  ATTKALMN      PICK UP DESIRED FILTER GAINS
0167  REF   1              21,2320  7 3101 0          MP     GAIN2
0168  REF  13  LAST  977   21,2321  51∝507 1          INDEX  DPNDX         ADOT  + (.16)(.1)DRHO
0169  REF   7  LAST  976   21,2322  21∝534 0          DAS    ADOT                -1
0170  REF   6  LAST  977   21,2323  51∝506 0          INDEX  SPNDX         S/C TORQUE TO INERTIA RATIO
0171  REF   3  LAST  691   21,2324  3 1620 1          CA     KMJ           SCALED (450)(1600)/(57.3)(16384)=1/1.3
0172                       21,2325  0 0006 1          EXTEND
0173  REF   7  LAST  977   21,2326  5 1506 0          INDEX  SPNDX
0174  REF   2  LAST  106   21,2327  7 1547 1          MP     DFT
0175  REF  14  LAST  977   21,2330  51∝507 1          INDEX  DPNDX
0176  REF   8  LAST  977   21,2331  21∝534 0          DAS    ADOT          KMJ(DFT)
0177  REF   8  LAST  977   21,2332  11∝506 1          CCS    SPNDX
0178  REF   1              21,2333  1 2275 1          TCF    ADOTLOOP      END CALCULATION OF VEHICLE RATES
0179  REF   2  LAST  107   21,2334  3 1560 0  KMATRIX CA     ATTSEC
0180  REF   2  LAST  833   21,2335  7 4721 0          MASK   LOW4
0181  REF 221  LAST  975   21,2336  10 000 0          CCS    A
0182  REF   1              21,2337  1 2345 0          TCF    TENTHSEK
0183  REF   5  LAST  974   21,2340  3 7671 0          CAF    PRIO34        CALL FOR 1 SEC UPDATE OF TRANSFORMATION
0184  REF  28  LAST  829   21,2341  0 5027 1          TC     NOVAC         MATRIX FROM GIMBAL AXES TO BODY AXES
0185  REF  18  LAST  976   E6,1510                    EBANK= KMPAC
0186  REF   1              21,2342   03444 0          2CADR  AMBGUPDT
0186  REF   1              21,2343   44066 1
0187  REF   4  LAST  918   21,2344  3 4334 1          CAF    NINE

0188  REF   3  LAST  977   21,2345  55∝560 1  TENTHSEK TS     ATTSEC
```

```
P0189   WHEN AUTOMATIC MANEUVERS ARE BEING PERFORMED, THE FOLLOWING ANGLE ADDITION MUST BE MADE TO PROVIDE A SMOOTH
R0191   SEQUENCE OF ANGULAR COMMANDS TO THE AUTOPILOT--

R0192           CDUXD = CDUXD + DELCDUX    (DOUBLE PRECISION)
R0193           CDUYD = CDUYD + DELCDUY    (DOUBLE PRECISION)
R0194           CDUZD = CDUZD + DELCDUZ    (DOUBLE PRECISION)

R0195   THE STEERING PROGRAMS-
R0196           1) ATTITUDE MANEUVER ROUTINE
R0198           2) LEM TRACKING

R0199   SHOULD GENERATE THE DESIRED ANGLES (CDUXD, CDUYD, CDUZD) AS WELL AS THE INCREMENTAL ANGLES (DELCDUX, DELCDUY,
R0201   DELCDUZ) SO THAT THE GIMBAL ANGLE COMMANDS CAN BE INTERPOLATED BETWEEN UPDATES.

R0203   HOLDFLAG CODING-

R0204       + = GRAB PRESENT CDU ANGLES AND STORE IN THETADX, THETADY, THETADZ
R0205           AND PERFORM ATTITUDE HOLD ABOUT THESE ANGLES
R0206           ALSO IGNORE AUTOMATIC STEERING
R0207           SET = + BY
R0208                 1) INITIALIZATION PHASE OF AUTOPILOT
R0209                 2) OCCURANCE OF RHC COMMANDS
R0210                 3) FREE MODE
R0211                 4) SWITCH OVER TO ATTITUDE HOLD FROM AUTO
R0212                    WHILE DOING AUTOMATIC STEERING (IN THIS CASE
R021203                  HOLDFLAG IS NOT ACTUALLY SET TO +, BUT THE LOGIC
R021205                  FUNCTIONS AS IF IT WERE.)
R02121                5) S/C CONTROL SWITCH IN SCS
R02122                6) IMU POWER OFF
R0213       +0 = IN ATTITUDE HOLD ABOUT A PREVIOUSLY ESTABLISHED REFERENCE
R0214       -  = PERFORMING AUTOMATIC MANEUVER
R0215       -0 = NOT USED AT PRESENT
R0216          NOTE THAT THIS FLAG MUST BE  SET = -  BY THE STEERING PROGRAM IF IT IS TO COMMAND THE AUTOPILOT.
R0218   SINCE ASTRONAUT ACTION MAY CHANGE THE HOLDFLAG SETTING, IT SHOULD BE MONITORED BY THE STEERING PROGRAM TO
R0220   DETERMINE IF THE AUTOMATIC SEQUENCE HAS BEEN INTERRUPTED AND IF SO, TAKE APPROPRIATE ACTION.
 0222   REF   9  LAST  975   21,2346  4 1332 0          CS      HOLDFLAG
 0223                        21,2347  0 0006 1          EXTEND
 0224   REF   1              21,2350  6 2375 1          BZMF    DACNDLS        IF HOLDFLAG +0,-0,+, BYPASS AUTOMATIC
A0225                                                                          COMMANDS
 0226   REF  40  LAST  977   21,2351  3 4711 1  DCDUINCR CAF     TWO
 0227   REF   9  LAST  977   21,2352  55<506 1  DELOOP   TS      SPNDX
 0228                        21,2353  6 0000 1          DOUBLE
 0229   REF  15  LAST  977   21,2354  55<507 0          TS      DPNDX
 0230                        21,2355  0 0006 1          EXTEND
 0231   REF 222  LAST  977   21,2356  5 0000 1          INDEX   A
 0232   REF   9  LAST  585   21,2357  3 1647 0          DCA     CDUXD
```

```
0233  REF  19  LAST  977   21,2360  53α511 1     DXCH   KMPAC
0234                      21,2361  0 0006 1     EXTEND
0235  REF  16  LAST  978   21,2362  5 1507 1     INDEX  DPNDX
0236  REF   6  LAST  586   21,2363  3 1576 1     DCA    DELCDUX
0237  REF   1             21,2364  0 2040 1     TC     DPADD
0238                      21,2365  0 0006 1     EXTEND
0239  REF  20  LAST  979   21,2366  3 1511 0     DCA    KMPAC
0240  REF  10  LAST  978   21,2367  51α506 0     INDEX  SPNDX
0241  REF   5  LAST  643   21,2370  55α572 1     TS     THETADX
0242  REF  17  LAST  979   21,2371  51α507 1     INDEX  DPNDX
0243  REF  10  LAST  978   21,2372  53α647 1     DXCH   CDUXD
0244  REF  11  LAST  979   21,2373  11α506 1     CCS    SPNDX
0245  REF   1             21,2374  1 2352 0     TCF    DELOOP
```

P0246 RCS-CSM AUTOPILOT ATTITUDE ERROR DISPLAY

R0247 THREE TYPES OF ATTITUDE ERRORS MAY BE DISPLAYED ON THE FDAI-

R0248 MODE 1) AUTOPILOT FOLLOWING ERRORS SELECTED BY V61E
R0250 GENERATED INTERNALLY BY THE AUTOPILOT

R0251 MODE 2) TOTAL ATTITUDE ERRORS SELECTED BY V62E
R0253 WITH RESPECT TO THE CONTENTS OF N22

R02531 MODE 3) TOTAL ASTRONAUT ATTITUDE ERRORS SELECTED BY V63E
R02533 WITH RESPECT TO THE CONTENTS OF N17

R0254 MODE 1 IS PROVIDED AS A MONITOR OF THE RCS DAP AND ITS ABILITY TO TRACK AUTOMATIC STEERING COMMANDS. IN THIS
R0256 MODE THE ATTITUDE ERRORS WILL BE ZEROED WHEN THE CMC MODE SWITCH IS IN FREE

R0259 MODE 2 IS PROVIDED TO ASSIST THE CREW IN MANUALLY MANEUVERING THE S/C TO THE ATTITUDE (GIMBAL ANGLES) SPECIFIED
R0261 IN N22. THE ATTITUDE ERRORS WRT THESE ANGLES AND THE CURRENT CDU ANGLES ARE RESOLVED INTO S/C CONTROL AXES
R0263 AS A FLY-TO INDICATOR.

R02631 MODE 3 IS PROVIDED TO ASSIST THE CREW IN MANUALLY MANEUVERING THE S/C TO THE ATTITUDE (GIMBAL ANGLES) SPECIFIED
R02633 IN N17. THE ATTITUDE ERRORS WRT THESE ANGLES AND THE CURRENT CDU ANGLES ARE RESOLVED INTO S/C CONTROL AXES
R02635 AS A FLY-TO INDICATOR.

R0264 V60 IS PROVIDED TO LOAD N17 WITH A SNAPSHOT OF THE CURRENT CDU ANGLES, THUS SYNCHRONIZING THE MODE 3 DISPLAY
R0266 WITH THE CURRENT S/C ATTITUDE. THIS VERB MAY BE USED AT ANY TIME.

R0269 THESE DISPLAYS WILL BE AVAILIABLE IN ANY MODE (AUTO, HOLD, FREE, G+N, OR SCS) ONCE THE RCS DAP HAS BEEN
R0271 INITIATED VIA V46E. MODE 1, HOWEVER, WILL BE MEANINGFUL ONLY IN G+N AUTO OR HOLD. THE CREW MAY PRESET (VIA
R0273 V25N17) AN ATTITUDE REFERENCE (DESIRED GIMBAL ANGLES) INTO N17 AT ANY TIME.

```
0278  REF  19  LAST  975   21,2375  4 1501 0  DACNDLS  CS     RCSFLAGS        ALTERNATE BETWEEN FDAIDSP1 AND FDAIDSP2
0279  REF  32  LAST  700   21,2376  7 4707 1            MASK   BIT4
0280                       21,2377  0 0006 1            EXTEND
0281  REF   1              21,2400  1 3144 1            BZF    FDAIDSP2

0282  REF  20  LAST  980   21,2401  27#501 0  FDAIDSP1  ADS    RCSFLAGS
0283  REF   7  LAST  904   21,2402  0 2404 0            TC     NEEDLER
0284  REF  33  LAST  933   21,2403  1 5222 1  KRESUME1  TCF    RESUME          END PHASE 1
```

L RCS-CSM DIGITAL AUTOPILOT USER'S PAGE NO. 9 E6 S3

P0285 FDAI ATTITUDE ERROR DISPLAY SUBROUTINE

R0286 PROGRAM DESCRIPTION' D. KEENE 5/24/67

R0287 THIS SUBROUTINE IS USED TO DISPLAY ATTITUDE ERRORS ON THE FDAI VIA THE DIGITAL TO ANALOG CONVERTERS (DACS)
R0289 IN THE CDUS. CARE IS TAKEN TO METER OUT THE APPROPRIATE NUMBER OF PULSES TO THE IMU ERROR COUNTERS AND PREVENT
R0291 OVERFLOW, TO CONTROL THE RELAY SEQUENCING, AND TO AVOID INTERFERENCE WITH THE COARSE ALIGN LOOP WHICH ALSO USES
R0293 THE DACS.
R0294 CALLING SEQUENCE'

R0295 DURING THE INITIALIZATION SECTION OF THE USER'S PROGRAM, BIT3 OF RCSFLAGS SHOULD BE SET TO INITIATE THE
R0297 TURN-ON SEQUENCE WITHIN THE NEEDLES PROGRAM'

```
R0298          CS     RCSFLAGS        IN EBANK6
R0299          MASK   BIT3
R0300          ADS    RCSFLAGS
```

R0301 THEREAFTER, THE ATTITUDE ERRORS GENERATED BY THE USER SHOULD BE TRANSFERED TO THE FOLLOWING LOCATIONS IN EBANK6'

```
R0303          AK     SCALED 180 DEGREES  NOTE' THESE LOCATIONS ARE SUBJECT
R0304          AK1    SCALED 180 DEGREES        TO CHANGE
R0305          AK2    SCALED 180 DEGREES
```

R0306 FULL SCALED DEFLECTION CORRESPONDS TO 16 7/8 DEGREES OF ATTITUDE ERROR
R0307 (= 384 BITS IN IMU ERROR COUNTER)

R0308 A CALL TO NEEDLER WILL THEN UPDATE THE DISPLAY'

```
R0309          INHINT
R0310          TC     IBNKCALL        NOTE' EBANK SHOULD BE SET TO E6
R0311          CADR   NEEDLER
R0312          RELINT
```

R0313 THIS PROCESS SHOULD BE REPEATED EACH TIME THE ERRORS ARE UPDATED. AT LEAST 3 PASSES THRU THE PROGRAM ARE
R0315 REQUIRED BEFORE ANYTHING IS ACTUALLY DISPLAYED ON THE ERROR METERS.
R0316 NOTE' EACH CALL TO NEEDLER MUST BE SEPARATED BY AT LEAST 50MS TO ASSURE PROPER RELAY SEQUENCING.

R0318 ERASABLE USED'

```
R0319                          AK          CDUXCMD
R0320                          AK1         CDUYCMD
R0321                          AK2         CDUZCMD
R0322                          EDRIVEX     A,L,Q
R0323                          EDRIVEY     T5TEMP
R0324                          EDRIVEZ     SPNDX

R0325 SWITCHES'                RCSFLAGS    BITS 3,2

R0326 I/O CHANNELS'            CHAN12      BIT 4 (COARSE ALIGN - READ ONLY)
```

```
R0327                          CHAN12     BIT 6 (IMU ERROR COUNTER ENABLE)
R0328                          CHAN14     BIT 13,14,15 (DAC ACTIVITY)
R0329   SIGN CONVENTION±    AK = THETAC - THETA
R0330           WHERE       THETAC = COMMAND ANGLE
R0331                       THETA  = PRESENT ANGLE
 0332   REF  33  LAST  980   21,2404  3 4707 0  NEEDLER  CAF    BIT4      CHECK FOR COARSE ALIGN ENABLE
 0333                        21,2405  0 0006 1           EXTEND           IF IN COARSE ALIGN DO NOT USE IMU
 0334   REF  33  LAST  918   21,2406  02 012 0           RAND   CHAN12    ERROR COUNTERS. DONT USE NEEDLES
 0335                        21,2407  0 0006 1           EXTEND
 0336   REF   1              21,2410  1 2415 1           BZF    NEEDLER1
 0337   REF  21  LAST  980   21,2411  4 1501 0           CS     RCSFLAGS  SET BIT3 FOR INITIALIZATION PASS
 0338   REF  29  LAST  960   21,2412  7 4710 1           MASK   BIT3
 0339   REF  22  LAST  982   21,2413  27∝501 0           ADS    RCSFLAGS
 0340   REF 191  LAST  970   21,2414  0 0002 0           TC     Q

 0341   REF  23  LAST  982   21,2415  3 1501 1  NEEDLER1 CA     RCSFLAGS
 0342   REF  28  LAST  737   21,2416  7 6211 1           MASK   SIX
 0343                        21,2417  0 0006 1           EXTEND
 0344   REF   1              21,2420  1 2455 0           BZF    NEEDLES3
 0345   REF  30  LAST  982   21,2421  7 4710 1           MASK   BIT3
 0346                        21,2422  0 0006 1           EXTEND
 0347   REF   2  LAST  243   21,2423  1 2446 1           BZF    NEEDLER2  BIT3 = 0, BIT2 = 1

 0348   REF  37  LAST  975   21,2424  4 4705 0           CS     BIT8      FIRST PASS BIT3 = 1
 0349                        21,2425  0 0006 1           EXTEND           DISABLE IMU ERROR COUNTER TO ZERO DACS
 0350   REF  34  LAST  982   21,2426  03 012 1           WAND   CHAN12    MUST WAIT AT LEAST 60 MS BEFORE
 0351   REF 174  LAST  973   21,2427  4 4714 0  NEEDLE11 CS     ZERO      ENABLING COUNTERS.
 0352   REF  13  LAST  904   21,2430  55∝476 1           TS     AK        ZERO THE INPUTS ON FIRST PASS
 0353   REF   4  LAST  928   21,2431  55∝477 0           TS     AK1
 0354   REF   4  LAST  934   21,2432  55∝500 1           TS     AK2
 0355   REF   2  LAST  113   21,2433  55∝503 1           TS     EDRIVEX   ZERO THE DISPLAY REGISTERS
 0356   REF   2  LAST  113   21,2434  55∝504 0           TS     EDRIVEY
 0357   REF   2  LAST  113   21,2435  55∝505 1           TS     EDRIVEZ
 0358   REF   2  LAST  148   21,2436  54 050 0           TS     CDUXCMD   ZERO THE OUT COUNTERS
 0359   REF   2  LAST  148   21,2437  54 051 1           TS     CDUYCMD
 0360   REF   2  LAST  148   21,2440  54 052 1           TS     CDUZCMD
 0361   REF  29  LAST  982   21,2441  4 6211 1           CS     SIX       RESET RCSFLAGS FOR PASS2
 0362   REF  24  LAST  982   21,2442  7 1501 0           MASK   RCSFLAGS
 0363   REF  41  LAST  958   21,2443  6 4711 1           AD     BIT2
 0364   REF  25  LAST  982   21,2444  55∝501 0           TS     RCSFLAGS
 0365   REF 192  LAST  982   21,2445  0 0002 0           TC     Q         END PASS1

 0366   REF  38  LAST  982   21,2446  3 4705 1  NEEDLER2 CAF    BIT6      ENABLE IMU ERROR COUNTERS
 0367                        21,2447  0 0006 1           EXTEND
 0368   REF  35  LAST  982   21,2450  05 012 1           WOR    CHAN12
 0369   REF  30  LAST  982   21,2451  4 6211 1           CS     SIX       RESET RCSFLAGS TO DISPLAY ATTITUDE
```

```
0370  REP  26  LAST  982   21,2452  7 1501 0          MASK   RCSFLAGS      ERRORS   WAIT ATLEAST 4 MS FOR
0371  REP  27  LAST  983   21,2453  55=501 0          TS     RCSFLAGS      RELAY CLOSURE
0372  REP 193  LAST  982   21,2454  0 0002 0          TC     Q
0373  REP  39  LAST  982   21,2455  3 4705 1  NEEDLES3 CAF    BIT6          CHECK TO SEE IF IMU ERROR COUNTER
0374                        21,2456  0 0006 1          EXTEND               IS ENABLED
0375  REP  36  LAST  982   21,2457  02 012 0          RAND   CHAN12
0376                        21,2460  0 0006 1          EXTEND               IF NOT RECYCLE NEEDLES
0377  REP   8  LAST  980   21,2461  1 2411 0          BZF    NEEDLER +5

0378  REP  41  LAST  978   21,2462  3 4711 1  NEEDLES CAF    TWO
0379  REP  12  LAST  979   21,2463  55=506 1  DACLOOP TS     SPNDX
0380  REP   3  LAST  976   21,2464  4 4676 0          CS     QUARTER
0381                        21,2465  0 0006 1          EXTEND
0382  REP  13  LAST  983   21,2466  5 1506 0          INDEX  SPNDX
0383  REP  14  LAST  982   21,2467  7 1476 1          MP     AK
0384  REP 121  LAST  969   21,2470  54 001 1          TS     L
0385  REP 223  LAST  978   21,2471  10 000 0          CCS    A
0386  REP   1               21,2472  3 2526 1          CA     DACLIMIT
0387                        21,2473  1 2475 1          TCF    +2
0388  REP   2  LAST  983   21,2474  4 2526 0          CS     DACLIMIT
0389  REP 122  LAST  983   21,2475  6 0001 0          AD     L
0390  REP   6  LAST  977   21,2476  55=502 0          TS     T5TEMP        OVFLO CHK
0391                        21,2477  1 2503 1          TCF    +4
0392  REP 224  LAST  983   21,2500  50 000 1          INDEX  A             ON OVERFLOW LIMIT OUTPUT TO +-384
0393  REP   3  LAST  983   21,2501  3 2526 1          CAF    DACLIMIT
0394  REP 123  LAST  983   21,2502  54 001 1          TS     L
0395  REP  14  LAST  983   21,2503  51=506 0          INDEX  SPNDX
0396  REP   3  LAST  982   21,2504  4 1503 1          CS     EDRIVEX       CURRENT VALUE OF DAC
0397  REP 124  LAST  983   21,2505  6 0001 0          AD     L
0398  REP  15  LAST  983   21,2506  51=506 0          INDEX  SPNDX
0399  REP   3  LAST  982   21,2507  26 050 0          ADS    CDUXCMD
0400  REP  16  LAST  983   21,2510  51=506 0          INDEX  SPNDX
0401  REP   4  LAST  983   21,2511  23=503 0          LXCH   EDRIVEX
0402  REP  17  LAST  983   21,2512  11=506 1          CCS    SPNDX
0403  REP   1               21,2513  1 2463 0          TCF    DACLOOP
0404  REP   4  LAST  588   21,2514  3 7707 0          CAF    13,14,15
0405                        21,2515  0 0006 1          EXTEND
0406  REP  11  LAST  946   21,2516  05 014 1          WOR    CHAN14        SET DAC ACTIVITY BITS
0407  REP 194  LAST  983   21,2517  0 0002 0          TC     Q

0408  REP   1               21,2520  3 2524 0  REINIT  CAF    DELAY200      .....TILT LOGIC
0409  REP  18  LAST  974   21,2521  54 030 0          TS     TIME5         REINITIALIZE DAP IN 200MS
0410  REP   7  LAST  974   21,2522  55=465 0          TS     T5PHASE
0411  REP  34  LAST  980   21,2523  1 5222 1          TCF    RESUME
0412                        21,2524   37754 0  DELAY200 DEC    16364         200MS
0413                        21,2525   77177 0          DEC    -384
```

```
0414                21,2526  37200 1  DACLIMIT DEC    16000
0415                21,2527  00600 1           DEC      384
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P0416 INITIALIZATION PROGRAM FOR RCS-CSM AUTOPILOT

R0417 THE FOLLOWING QUANTITIES WILL BE ZEROED AND SHOULD APPEAR IN CONSECUTIVE LOCATIONS IN MEMORY AFTER WBODY

R0419	WBODY (+1)	DPT		TAU2	
R0420	WBODY1 (+1)	DPT1		BIAS	
R0421	WBODY2 (+1)	DPT2		BIAS1	
R0422	ADOT (+1)	DRHO (+1)		BIAS2	
R0423	ADOT1 (+1)	DRHO1 (+1)		ERRORX	
R0424	ADOT2 (+1)	DRHO2 (+1)		ERRORY	
R0425	MERRORX (+1)	ATTSEC		ERRORZ	
R0426	MERRORY (+1)	TAU			
R0427	MERRORZ (+1)	TAU1			

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 0428   REF 103  LAST  973   21,2530  3 4712 1  FRESHDAP CAF    ONE          RESET HOLDFLAG TO STOP AUTOMATIC
 0429   REF  10  LAST  978   21,2531  55=332 0           TS     HOLDFLAG     STEERING AND PREPARE TO PICK UP AN
A0430                                                                       ATTITUDE HOLD REFERENCE

 0431   REF  36  LAST  905   21,2532  0 4633 0  REDAP    TC     IBNKCALL     DECODE DAPDATR1, DAPDATR2 FOR DEADBANDS
 0432   REF   2  LAST  247   21,2533   40146 0           CADR   S41.2        RATES, QUADFAILS, QUAD MANAGEMENT

 0433   REF  37  LAST  985   21,2534  0 4633 0           TC     IBNKCALL     DECODE IXX, IAVG AND CONVERT
 0434   REF   2  LAST  248   21,2535   40277 1           CADR   S40.14       TO AUTOPILOT GAINS

 0436   REF   1              21,2536  3 2607 1           CAF    NO.T5VAR     NO. LOCATIONS TO BE ZEROED MINUS ONE
 0437   REF  18  LAST  983   21,2537  55=506 1  ZEROT5   TS     SPNDX        ZERO ALL NECESSARY ERASABLE REGISTERS
 0438   REF 175  LAST  982   21,2540  3 4714 1           CAF    ZERO
 0439   REF  19  LAST  985   21,2541  51=506 0           INDEX  SPNDX
 0440   REF  10  LAST  585   21,2542  55=525 0           TS     WBODY
 0441   REF  20  LAST  985   21,2543  11=506 1           CCS    SPNDX
 0442   REF   1              21,2544  1 2537 0           TCF    ZEROT5
 0443   REF   4  LAST  974   21,2545  0 2616 1           TCR    ZEROJET

 0444   REF 176  LAST  985   21,2546  4 4714 0           CS     ZERO
 0445   REF   2  LAST  107   21,2547  55=633 1           TS     CHANTEMP     INITIALIZE MINIMUM IMPULSE CONTROL

 04451  REF   2  LAST  107   21,2550  55=632 0           TS     CH31TEMP     INITIALIZE RHC POSITION MEMORY FOR
A04452                                                                      MANUAL RATE MODES
 0446   REF   1              21,2551  3 2610 1           CAF    =.24
 0447   REF   2  LAST  108   21,2552  55=654 0           TS     SLOPE        INITIALIZE SWITCHING LOGIC SLOPE

 0448   REF  11  LAST  906   21,2553  3 4710 0           CAF    FOUR
 0449   REF   3  LAST  974   21,2554  55=634 0           TS     T5TIME       PHASE 0 RESETS FOR PHASE 2 INTERRUPT IN
A0450                                                                       60MS. PHASE 2 RESETS FOR PHASE 1 RUPT
A04501                                                                      IN (80MS - T5TIME(40MS)). THEREFORE
A04502                                                                      PHASE 1 (RATEFILTER) BEGINS CYCLING 100
A04503                                                                      MS FROM NOW AND EVERY 100MS THEREAFTER

 0451   REF   5  LAST  784   21,2555  3 4717 1           CAF    ELEVEN
 0452   REF   4  LAST  977   21,2556  55=617 1           TS     ATTKALMN     RESET TO PICK UP KALMAN FILTER GAINS
A0453                                                                       TO INITIALIZE THE S/C ANGULAR RATES
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 0473   REF  21  LAST  976   21,2557  3 0032 0          CA    CDUX
 0474   REF   4  LAST  976   21,2560  55=635 1          TS    RHO
 0475   REF  12  LAST  976   21,2561  3 0033 1          CA    CDUY
 0476   REF   4  LAST  976   21,2562  55=636 1          TS    RHO1
 0477   REF  15  LAST  976   21,2563  3 0034 0          CA    CDUZ
 0478   REF   4  LAST  976   21,2564  55=637 0          TS    RHO2
 0479   REF 177  LAST  985   21,2565  3 4714 1          CAF   ZERO      RESET AUTOPILOT TO BEGIN EXECUTING
 0480   REF   8  LAST  983   21,2566  55=465 0          TS    T5PHASE   PHASE2 OF PROGRAM

 0481   REF  27  LAST  975   21,2567  4 1321 1          CS    IMODES33  CHECK IMU STATUS
 0482   REF  40  LAST  983   21,2570  7 4705 0          MASK  BIT6      IF BIT6 = 0 IMU IN FINE ALIGN
 0483   REF 225  LAST  983   21,2571  10 000 0          CCS   A         IF BIT6 = 1 IMU NOT READY
 0484   REF   1              21,2572  1 2576 0          TCF   IMUAOK
 0485   REF   5  LAST  985   21,2573  55=617 1          TS    ATTKALMN  CANNOT USE IMU
 0486   REF   1              21,2574  3 2612 0          CAF   RCSINITB  PROVIDE FREE CONTROL ONLY
 0487   REF   1              21,2575  1 2603 1          TCF   RCSSWIT   DONT START UP RATE FILTER
A0488                                                                  SIGNAL NO RATE FILTER

 0489   REF   6  LAST  977   21,2576  3 7671 0  IMUAOK  CAF   PRIO34   START MATRIX INITIALIZATION
 0490   REF  29  LAST  977   21,2577  0 5027 1          TC    NOVAC     BYPASS IF IMU NOT IN FINE ALIGN
 0491   REF  21  LAST  979   E6,1510                    EBANK= KMPAC
 0492   REF   2  LAST  977   21,2600   03444 0          2CADR AMBGUPDT
 0492                        21,2601   44066 1
 0493   REF   1              21,2602  3 2611 0          CAF   RCSINIT   CLEAR BIT14 -ASSUME WE HAVE A GOOD IMU
 0494   REF  28  LAST  983   21,2603  55=501 0  RCSSWIT  TS    RCSFLAGS  CLEAR BIT1  -INITIALIZE T6 PROGRAM
A0495                                                                    SET BIT3  -INITIALIZE NEEDLES
A0496                                                                  CLEAR BIT4  -RESET FOR FDAIDSP1
 0497   REF   1              21,2604  3 2613 1          CAF   T5WAIT60  NEXT T5RUPT 60 MS FROM NOW TO ALLOW IMU
A0498                                                                  ERROR COUNTER TO ZERO.
A0499                                                                  (MINIMUM DELAY = 15 MS)
 0500   REF  19  LAST  983   21,2605  54 030 0          TS    TIME5     SINCE ATTKALMN IS +11, PROGRAM WILL THEN
 0501   REF  35  LAST  983   21,2606  0 5222 0          TC    RESUME    PICK UP THE KALMAN FILTER GAINS. RATE
A0502                                                                  FILTER WILL BEGIN OPERATING ZOOMS FROM
A0503                                                                  NOW

R0504  CONSTANTS USED IN INITIALIZATION PROGRAM

 0505                        21,2607   00044 1  NO.T5VAR DEC   36
 0506                        21,2610   07534 1  =.24     DEC   .24       = SLOPE OF 0.6/SEC
 0507                        21,2611   00004 0  RCSINIT  OCT   00004
 0508                        21,2612   20004 1  RCSINITB OCT   20004
 0509                        21,2613   37772 1  T5WAIT60 DEC   16378     = 6 CS
 0510   REF  22  LAST  986   E6,1510                    EBANK= KMPAC
 0511   REF   1              21,2614   03644 1  T6ADDR   2CADR T6START
 0511   REF   1              21,2615   36066 1
053001  REF   6  LAST  985   21,2616  3 4717 1  ZEROJET  CAF   ELEVEN    ZERO BLAST2, BLAST1, BLAST, YWORD2,
053002  REF  21  LAST  985   21,2617  55=506 1           TS    SPNDX     YWORD1, PWORD2, PWORD1, RWORD2,
053003  REF 178  LAST  986   21,2620  3 4714 1           CAF   ZERO      AND RWORD1.
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053004 REF  22 LAST 986  21,2621  51=506 0          INDEX  SPNDX
053005 REF   2 LAST 100  21,2622  55=451 1          TS     RWORD1
053006 REF  23 LAST 987  21,2623  11=506 1          CCS    SPNDX
053007 REF   5 LAST 985  21,2624  1 2617 1          TCF    ZEROJET +1

053008 REF  12 LAST 985  21,2625  3 4710 0          CAF    FOUR
053009 REF   2 LAST 100  21,2626  55=462 1          TS     BLAST1 +1
05301  REF   7 LAST 986  21,2627  3 4717 1          CAF    ELEVEN
0531   REF   2 LAST 100  21,2630  55=464 1          TS     BLAST2 +1

0532   REF  68 LAST 958  21,2631  4 4712 0          CS     BIT1
0533   REF  29 LAST 986  21,2632  7 1501 0          MASK   RCSFLAGS
0534   REF  30 LAST 987  21,2633  55=501 0          TS     RCSFLAGS      RESET BIT1 OF RCSFLAGS TO 0

0535                     21,2634  0 0006 1          EXTEND
0536   REF   1           21,2635  3 2615 1          DCA    T6ADDR
0537   REF   3 LAST 957  21,2636  53=311 1          DXCH   T6LOC
0538   REF   1           21,2637  3 3034 0          CAF    =+14MS        ENABLE T6RUPT TO SHUT OFF JETS IN 14 MS.
0539   REF   3 LAST 957  21,2640  54 031 1          TS     TIME6
0540   REF  41 LAST 973  21,2641  3 4674 0          CAF    BIT15
0541                     21,2642  0 0006 1          EXTEND
0542   REF   9 LAST 958  21,2643  05 013 0          WOR    CHAN13

0543   REF 195 LAST 983  21,2644  0 0002 0          TC     Q

0544   REF   6 LAST 986  21,2645  11=617 1 T5PHASE2 CCS    ATTKALMN      IF (+) INITIALIZE RATE ESTIMATE
0545   REF   1           21,2646  1 3132 0          TCF    KALUPDT
0546                     21,2647  1 2651 0          TCF    +2            ONLY IF ATTKALMN POSITIVE
0547                     21,2650  1 2651 0          TCF    +1
0548   REF   2 LAST 974  21,2651  3 2142 1          CA     DELTATT2      RESET FOR PHASE3 IN 20 MS
0549   REF  20 LAST 986  21,2652  56 030 1          XCH    TIME5         (JET SELECTION LOGIC )
0550   REF   4 LAST 985  21,2653  27=634 0          ADS    T5TIME        TO COMPENSATE FOR DELAYS IN T5RUPT
05501  REF  31 LAST 987  21,2654  3 1501 1          CA     RCSFLAGS      IF A HIGH RATE AUTO MANEUVER IS IN
05502  REF  42 LAST 987  21,2655  7 4674 1          MASK   BIT15         PROGRESS (BIT 15 OF RCSFLAGS SET), SET
05503                     21,2656  0 0006 1          EXTEND               ATTKALMN TO -1
05504  REF   1           21,2657  1 2661 0          BZF    NOHIAUTO      OTHERWISE SET ATTKALMN TO 0.
05505  REF 104 LAST 985  21,2660  4 4712 0          CS     ONE
05506  REF   7 LAST 987  21,2661  55=617 1 NOHIAUTO TS     ATTKALMN
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P0551          MANUAL ROTATION COMMANDS
0552  REF   1                21,2662  4 3016 1          CS     OCT01760   RESET FORCED FIRING BITS (BITS 10 TO 5
0553  REF  32  LAST  987      21,2663  7 1501 0          MASK   RCSFLAGS   OF RCSFLAGS) TO ZERO
0554  REF  33  LAST  988      21,2664  55α501 0          TS     RCSFLAGS

0555                          21,2665  0 0006 1          EXTEND
0556  REF   8  LAST  975      21,2666  00 031 0          READ   CHAN31
0557  REF 125  LAST  983      21,2667  54 001 1          TS     L
0558  REF   3  LAST  985      21,2670  3 1632 1          CA     CH31TEMP
0559                          21,2671  0 0006 1          EXTEND
0560  REF  11  LAST  945      21,2672  06 001 0          RXOR   LCHAN
0561  REF   1                21,2673  7 3022 0          MASK   MANROT     = OCT00077
0562                          21,2674  0 0006 1          EXTEND
0563  REF   1                21,2675  6 2710 0          BZMF   NOCHANGE

0564  REF 226  LAST  986      21,2676  22 000 1          LXCH   A
0565  REF   4  LAST  988      21,2677  55α632 0          TS     CH31TEMP   SAVE CONTENTS OF CHANNEL 31 IN CH31TEMP

0566  REF 126  LAST  988      21,2700  3 0001 0          CA     L
0567                          21,2701  0 0006 1          EXTEND
0568  REF  35  LAST  952      21,2702  7 4706 0          MP     BIT5       PUT BITS 6-1 OF A IN BITS 10-5 OF L
0569  REF 127  LAST  988      21,2703  3 0001 0          CA     L
0570  REF  34  LAST  988      21,2704  27α501 0          ADS    RCSFLAGS   SET FORCED FIRING BITS FOR AXES WITH
A0571                                                                     WITH CHANGES IN COMMAND. BITS 10,9 FOR
A0572                                                                     ROLL, BITS 8,7 FOR YAW, BITS 6,5 FOR
A0573                                                                     PITCH

0574  REF  35  LAST  988      21,2705  4 1501 0          CS     RCSFLAGS   SET RATE DAMPING FLAGS (BITS 13,12,AND
0575  REF   1                21,2706  7 3023 1          MASK   OCT16000   11 OF RCSFLAGS)
0576  REF  36  LAST  988      21,2707  27α501 0          ADS    RCSFLAGS

0577  REF   5  LAST  988      21,2710  4 1632 0  NOCHANGE CS     CH31TEMP
0578  REF   2  LAST  988      21,2711  7 3022 0          MASK   MANROT
0579                          21,2712  0 0006 1          EXTEND
0580  REF   1                21,2713  6 3234 1          BZMF   AHFNOROT   IF NO MANUAL COMMANDS, GO TO AHFNOROT

0581  REF  11  LAST  985      21,2714  55α332 0          TS     HOLDFLAG   SET HOLDFLAG +

0582  REF   2  LAST  539      21,2715  0 3114 0          TC     STICKCHK   WHEN THE RHC IS OUT OF DETENT, PMANNDX,
A0583                                                                     YMANNDX, AND RMANNDX ARE ALL SET, BY
A0584                                                                     MEANS OF STICKCHK, TO 0, 1, OR 2 FOR NO,
A0585                                                                     +, OR - ROTATION RESPECTIVELY AS
A0586                                                                     COMMANDED BY THE RHC.

A0587                                                                     HOWEVER, IT IS WELL TO NOTE THAT AFTER
A0588                                                                     THE RHC IS RETURNED TO DETENT, THE
A0589                                                                     PROGRAM BRANCHES TO AHFNOROT AND AVOIDS
A0590                                                                     STICKCHK SO PMANNDX, YMANNDX, AND
A0591                                                                     RMANNDX ARE NOT RESET TO ZERO BUT RATHER
A0592                                                                     LEFT SET TO THEIR LAST OUT OF DETENT
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A0593                                                                   VALUES.

 0594   REF  22  LAST  779   21,2716  4 0075 1        CS      FLAGWRD1    SET STIKFLAG TO INFORM STEERING
 0595   REF  56  LAST  975   21,2717  7 4675 0        MASK    BIT14       PROGRAMS (P20) THAT ASTRONAUT HAS
 0596   REF  23  LAST  989   21,2720  26 075 1        ADS     FLAGWRD1    ASSUMED ROTATIONAL CONTROL OF SPACECRAFT

 0597   REF  57  LAST  989   21,2721  3 4675 1        CAF     BIT14
 0598                        21,2722  0 0006 1        EXTEND
 0599   REF   9  LAST  988   21,2723  02 031 1        RAND    CHAN31
 0600                        21,2724  0 0006 1        EXTEND
 0601   REF   1              21,2725  6 3035 1        BZMF    FREEFUNC

 0602   REF  37  LAST  988   21,2726  3 1501 1        CA      RCSFLAGS    EXAMINE RCSFLAGS TO SEE IF RATE FILTER
 0603   REF  58  LAST  989   21,2727  7 4675 0        MASK    BIT14       HAS BEEN INITIALIZED
 0604   REF 227  LAST  988   21,2730  10 000 0        CCS     A           IF SO, PROCEED WITH MANUAL RATE COMMANDS
 0605   REF   2  LAST  975   21,2731  1 2520 0        TCF     REINIT      .....TILT, RECYCLE TO INITIALIZE FILTER

 0606   REF  24  LAST  960   21,2732  4 4715 1        CS      FIVE        IF MANUAL MANEUVER IS AT HIGH RATE, SET
 0607   REF   5  LAST  688   21,2733  6 1130 1        AD      RATEINDX    ATTKALMN TO -1.
 0608                        21,2734  0 0006 1        EXTEND              OTHERWISE, LEAVE ATTKALMN ALONE.
 0609                        21,2735  6 2740 0        BZMF    +3
 0610   REF 105  LAST  987   21,2736  4 4712 0        CS      ONE
 0611   REF   8  LAST  987   21,2737  55#617 1        TS      ATTKALMN
 0614   REF  42  LAST  983   21,2740  3 4711 1        CAF     TWO         AUTO-HOLD MANUAL ROTATION
 0615   REF  24  LAST  987   21,2741  55#506 1  SETWBODY TS     SPNDX
 0616                        21,2742  6 0000 1        DOUBLE
 0617   REF  18  LAST  979   21,2743  55#507 0        TS      DPNDX
 0618   REF  25  LAST  989   21,2744  51#506 0        INDEX   SPNDX       RMANNDX = 0 NO ROTATION
 0619   REF   3  LAST  539   21,2745  3 1656 0        CA      RMANNDX             = 1  + ROTATION
 0620                        21,2746  0 0006 1        EXTEND              = 2  - ROTATION
 0621   REF   1              21,2747  1 2771 0        BZF     NORATE      IF NO ROTATION COMMAND ON THIS AXIS,
A0622                                                                   GO TO NORATE.

 0623   REF   6  LAST  989   21,2750  6 1130 1        AD      RATEINDX    RATEINDX = 0  0.05 DEG/SEC
 0624   REF 196  LAST  987   21,2751  54 002 1        TS      Q                    = 2  0.2 DEG/SEC
 0625   REF 197  LAST  989   21,2752  50 002 0        INDEX   Q                    = 4  0.5 DEG/SEC
 0626   REF   1              21,2753  3 3023 0        CA      MANTABLE -1          = 6  4.0 DEG/SEC
 0627                        21,2754  0 0006 1        EXTEND
 0628   REF  29  LAST  783   21,2755  7 4702 1        MP      BIT9        MULTIPLY MANTABLE BY 2 TO THE -6
 0629   REF  19  LAST  989   21,2756  51#507 1        INDEX   DPNDX       TO GET COMMANDED RATE.
 0630   REF  11  LAST  985   21,2757  53#526 0        DXCH    WBODY       SET WBODY TO COMMANDED RATE.

 0631   REF  38  LAST  989   21,2760  3 1501 1        CA      RCSFLAGS
 0632   REF   2  LAST  988   21,2761  7 3023 1        MASK    OCT16000    IS RATE DAMPING COMPLETED (BITS 13,12AND
 0633                        21,2762  0 0006 1        EXTEND              11 OF RCSFLAGS ALL ZERO.) IF SO, GO TO
 0634   REF   1              21,2763  1 3001 1        BZF     MERUPDAT    MERUPDAT TO UPDATE CUMULATIVE ATTITUDE
A0635                                                                   ERROR.
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 0636   REF 179 LAST 986   21,2764  3 4714 1  ZEROER   CA     ZERO          ZEROER ZEROS MERRORS
 0637                      21,2765  22 007 0             ZL
 0638   REF  20 LAST 989   21,2766  51"507 1             INDEX  DPNDX
 0639   REF   3 LAST 977   21,2767  53"542 1             DXCH   MERRORX
 0640   REF   1            21,2770  1 3007 1             TCF    SPNDXCHK

 0641                      21,2771  22 007 0  NORATE     ZL
 0642   REF  21 LAST 990   21,2772  51"507 1             INDEX  DPNDX
 0643   REF  12 LAST 989   21,2773  53"526 0             DXCH   WBODY          ZERO WBODY FOR THIS AXIS
 0644   REF  39 LAST 989   21,2774  3 1501 1             CA     RCSFLAGS
 0645   REF   3 LAST 989   21,2775  7 3023 1             MASK   OCT16000
 0646                      21,2776  0 0006 1             EXTEND                IS RATE DAMPING COMPLETED
 0647   REF   2 LAST 990   21,2777  1 3007 1             BZF    SPNDXCHK       YES, KEEP CURRENT MERRORX GO TO SPNDXCHK
 0648   REF   1            21,3000  1 2764 1             TCF    ZEROER         NO,GO TO ZEROER

 0649   REF 198 LAST 989   21,3001  50 002 0  MERUPDAT   INDEX  0             MERRORX=MERRORX+MEASURED CHANGE IN ANGLE
 0650   REF   2 LAST 989   21,3002  4 3023 1             CS     MANTABLE -1    -COMMANDED CHANGE IN ANGLE
 0651                      21,3003  0 0006 1             EXTEND                THE ADDITION OF MEASURED CHANGE IN ANGLE
 0652   REF  43 LAST 784   21,3004  7 4704 1             MP     BIT7           HAS ALREADY BEEN DONE IN THE RATE FILTER
 0653   REF  22 LAST 990   21,3005  51"507 1             INDEX  DPNDX          COMMANDED CHANGE IN ANGLE = WBODY TIMES
 0654   REF   4 LAST 990   21,3006  21"542 1             DAS    MERRORX        .1SEC = MANTABLE ENTRY TIMES 2 TO THE -8

 0655   REF  23 LAST 990   21,3007  51"507 1  SPNDXCHK   INDEX  DPNDX
 0656   REF   5 LAST 990   21,3010  3 1541 0             CA     MERRORX
 0657   REF  26 LAST 989   21,3011  51"506 0             INDEX  SPNDX
 0658   REF   6 LAST 973   21,3012  55"567 0             TS     ERRORX         ERRORX = HIGH ORDER WORD OF MERRORX
 0659   REF  27 LAST 990   21,3013  11"506 1             CCS    SPNDX
 0660   REF   1            21,3014  1 2741 0             TCF    SETWBODY
 0661   REF   1            21,3015  1 3425 0             TCF    JETS
 0662                      21,3016   01760 1  OCT01760   OCT    01760          FORCED FIRING BITS MASK

 0663                      21,3017   01400 1  OCT01400   OCT    01400          ROLL FORCED FIRING MASK      ORDER OF
 0664                      21,3020   00060 1  OCT00060   OCT    00060          PITCH FORCED FIRING MASK     DEFINITION
 0665                      21,3021   00300 1  OCT00300   OCT    00300          YAW FORCED FIRING MASK       MUST BE
A0666                                                                                                     PRESERVED
A0667                                                                                                   FOR INDEXING
 0668                      21,3022   00077 1  MANROT     OCT    77
 0669                      21,3023   16000 0  OCT16000   OCT    16000          RATE DAMPING FLAGS MASK
 0670                      21,3024   00165 0  MANTABLE   DEC    .0071111
 0671                      21,3025   77612 1             DEC    -.0071111
 0672                      21,3026   00722 0             DEC    .028444
 0673                      21,3027   77055 1             DEC    -.028444
 0674                      21,3030   02215 0             DEC    .071111
 0675                      21,3031   75562 1             DEC    -.071111
 0676                      21,3032   22151 1             DEC    .568889
 0677                      21,3033   55626 0             DEC    -.568889
 0678                      21,3034   00027 1  =+14MS     DEC    23
 0679   REF   4 LAST 989   21,3035  51"656 0  FREEFUNC   INDEX  RMANNDX        ACCELERATION
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0680  REF   1                 21,3036  3 3047 1          CA     FREETAU     COMMANDS
0681  REF   2  LAST  107      21,3037  55∝561 0          TS     TAU
0682  REF   3  LAST  540      21,3040  51∝657 1          INDEX  PMANNDX
0683  REF   2  LAST  991      21,3041  3 3047 1          CA     FREETAU     FREETAU    0 SEC
0684  REF   2  LAST  107      21,3042  55∝562 0          TS     TAU1        +1        +0.10 SEC
0685  REF   3  LAST  540      21,3043  51∝660 0          INDEX  YMANNDX     +2        -0.10 SEC
0686  REF   3  LAST  991      21,3044  3 3047 1          CA     FREETAU     (+3)       0 SEC
0687  REF   2  LAST  107      21,3045  55∝563 1          TS     TAU2
0688  REF   1                 21,3046  1 3053 0          TCF    T6PROGM

0689                          21,3047   00000 1  FREETAU  DEC    0
0690                          21,3050   00740 1          DEC    480
0691                          21,3051   77037 0          DEC    -480
0692                          21,3052   00000 1          DEC    0

0693  REF 180  LAST  990      21,3053  3 4714 1  T6PROGM  CAF    ZERO        FOR MANUAL ROTATIONS
0694  REF   7  LAST  990      21,3054  55∝567 0          TS     ERRORX
0695  REF   4  LAST  973      21,3055  55∝570 0          TS     ERRORY
0696  REF   3  LAST  973      21,3056  55∝571 1          TS     ERRORZ
0697  REF   1                 21,3057  1 3743 0          TCF    T6PROG
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06975                          21,3060   06604 0          DEC    .2112     FILTER GAIN FOR TRANSLATION, LEM ON
0698                           21,3061   32703 1          DEC    .8400     FILTER GAIN FOR TRANSLATION 2(ZETA)WN DT
0699                           21,3062   06604 0          DEC    .2112     FILTER GAIN FOR 4 DEGREE/SEC MANEUVERS
0700                           21,3063   02031 1  GAIN1   DEC    .0640     KALMAN FILTER GAINS FOR INITIALIZATION
0701                           21,3064   12132 1          DEC    .3180     OF ATTITUDE RATES
0702                           21,3065   13030 0          DEC    .3452
0703                           21,3066   14047 1          DEC    .3774
0704                           21,3067   15241 1          DEC    .4161
0705                           21,3070   16650 0          DEC    .4634
0706                           21,3071   20555 0          DEC    .5223
0707                           21,3072   23065 0          DEC    .5970
0708                           21,3073   26137 0          DEC    .6933
0709                           21,3074   32053 0          DEC    .8151
0710                           21,3075   35712 0          DEC    .9342

07105                          21,3076   00435 0          DEC    .0174     FILTER GAIN FOR TRANSLATION, LEM ON
0711                           21,3077   13412 1          DEC    .3600     FILTER GAIN FOR TRANSLATION (WN)(WN)DT
0712                           21,3100   00435 0          DEC    .0174     FILTER GAIN FOR  4 DEGREE/SEC MANEUVERS
0713                           21,3101   00032 0  GAIN2   DEC    .0016     SCALED 10
0714                           21,3102   01350 0          DEC    .0454
0715                           21,3103   01575 1          DEC    .0545
0716                           21,3104   02103 1          DEC    .0666
0717                           21,3105   02523 1          DEC    .0832
0718                           21,3106   03327 1          DEC    .1069
0719                           21,3107   04432 0          DEC    .1422
0720                           21,3110   06264 1          DEC    .1985
0721                           21,3111   11351 0          DEC    .2955
0722                           21,3112   17324 1          DEC    .4817
0723                           21,3113   33622 1          DEC    .8683
0724   REF   7  LAST  983      21,3114   55∝502 0  STICKCHK TS     T5TEMP
0725   REF  28  LAST  904      21,3115   7 6214 1          MASK   THREE     INDECES FOR MANUAL ROTATION
0726   REF   4  LAST  991      21,3116   55∝657 0          TS     PMANNDX
0727   REF   8  LAST  992      21,3117   3 1502 1          CA     T5TEMP
0728                           21,3120   0 0006 1          EXTEND           MAN RATE 0   0 RATE (DP)
0729   REF   4  LAST  983      21,3121   7 4676 0          MP     QUARTER          +1   +RATE (DP)
0730   REF   9  LAST  992      21,3122   55∝502 0          TS     T5TEMP           +2   -RATE (DP)
0731   REF  29  LAST  992      21,3123   7 6214 1          MASK   THREE           (+3)  0 RATE (DP)
0732   REF   4  LAST  991      21,3124   55∝660 1          TS     YMANNDX
0733   REF  10  LAST  992      21,3125   3 1502 1          CA     T5TEMP
0734                           21,3126   0 0006 1          EXTEND
0735   REF   5  LAST  992      21,3127   7 4676 0          MP     QUARTER
0736   REF   5  LAST  990      21,3130   55∝656 1          TS     RMANNDX
0737   REF 199  LAST  990      21,3131   0 0002 0          TC     Q
0738   REF   9  LAST  989      21,3132   55∝617 1  KALUPDT TS     ATTKALMN   INITIALIZATION OF ATTITUDE RATES USING
A0739                                                                        KALMAN FILTER TAKES 1.1 SEC

0740   REF   1                 21,3133   3 2141 1          CA     DELTATT    =1SEC - 80MS
0741   REF   5  LAST  987      21,3134   6 1634 1          AD     T5TIME     + DELAYS
```

```
0742  REF  21  LAST  987   21,3135  54 030 0            TS    TIME5
0743                       21,3136  1 3141 1            TCF   +3
0744  REF   3  LAST  987   21,3137  3 2142 1            CAF   DELTATT2     SAFETY PLAY TO ASSURE
0745  REF  22  LAST  993   21,3140  54 030 0            TS    TIME5        A T5RUPT
0752  REF 181  LAST  991   21,3141  4 4714 0  KRESUME2  CS    ZERO         RESET FOR PHASE1
0753  REF   9  LAST  986   21,3142  55"465 0            TS    T5PHASE      RESUME INTERRUPTED PROGRAM
0754  REF  36  LAST  986   21,3143  1 5222 1            TCF   RESUME
0755  REF  34  LAST  982   21,3144  4 4707 1  FDAIDSP2  CS    BIT4         RESET FOR FDAIDSP1
0756  REF  40  LAST  990   21,3145  7 1501 0            MASK  RCSFLAGS
0757  REF  41  LAST  993   21,3146  55"501 0            TS    RCSFLAGS

0758  REF  11  LAST  784   21,3147  4 0074 0            CS    FLAGWRD0     ON - DISPLAY ONE OF THE TOTAL ATTITUDE
0759  REF  30  LAST  989   21,3150  7 4702 1            MASK  BIT9         ERRORS
0760                       21,3151  0 0006 1            EXTEND
0761  REF   1              21,3152  1 3161 0            BZF   FDAITOTL
0762                       21,3153  0 0006 1            EXTEND
0763  REF   8  LAST  991   21,3154  4 1570 0            DCS   ERRORX       OFF -DISPLAY AUTOPILOT FOLLOWING ERROR
0764  REF  15  LAST  983   21,3155  53"477 0            DXCH  AK
0765  REF   4  LAST  991   21,3156  4 1571 1            CS    ERRORZ
0766  REF   5  LAST  982   21,3157  55"500 1            TS    AK2
0767  REF  37  LAST  993   21,3160  1 5222 1            TCF   RESUME       END PHASE 1
0768  REF  14  LAST  906   21,3161  3 0105 0  FDAITOTL  CA    FLAGWRD9
07681 REF  41  LAST  986   21,3162  7 4705 0            MASK  BIT6
07682                      21,3163  0 0006 1            EXTEND
07683 REF   1              21,3164  1 3227 1            BZF   WRTN17       IS N22ORN17 (BIT6 OF FLAGWRD9) = 0
A07684                                                                     IF SO, GO TO WRTN17
07685                      21,3165  0 0006 1  WRTN22    EXTEND             OTHERWISE, CONTINUE ON TO WRTN22 AND
0769  REF   2  LAST  412   21,3166  3 1157 0            DCA   CTHETA       GET SET TO COMPUTE TOTAL ATTITUDE
0770  REF   2  LAST  106   21,3167  53"514 1            DXCH  WTEMP        ERROR WRT N22 BY PICKING UP THE THREE
0771  REF   9  LAST  586   21,3170  3 1155 1            CA    CPHI         COMPONENTS OF N22

0772                       21,3171  0 0006 1  GETAKS    EXTEND             COMPUTE TOTAL ATTITUDE ERROR FOR
0773  REF  22  LAST  986   21,3172  20 032 1            MSU   CDUX         DISPLAY ON FDAI ERROR NEEDLES
0774  REF  16  LAST  993   21,3173  55"476 1            TS    AK
0775  REF   3  LAST  993   21,3174  3 1513 1            CA    WTEMP
0776                       21,3175  0 0006 1            EXTEND
0777  REF  13  LAST  986   21,3176  20 033 0            MSU   CDUY
0778  REF  11  LAST  992   21,3177  55"502 0            TS    T5TEMP
0779                       21,3200  0 0006 1            EXTEND
0780  REF   3  LAST  976   21,3201  7 1640 0            MP    AMGB1
0781  REF  17  LAST  993   21,3202  27"476 1            ADS   AK
0782  REF  12  LAST  993   21,3203  3 1502 1            CA    T5TEMP
0783                       21,3204  0 0006 1            EXTEND
0784  REF   3  LAST  976   21,3205  7 1641 1            MP    AMGB4
```

```
0785  REF   5  LAST  982   21,3206  55=477 0          TS      AK1
0786  REF  13  LAST  993   21,3207  3 1502 1          CA      T5TEMP
0787                       21,3210  0 0006 1          EXTEND
0788  REF   3  LAST  976   21,3211  7 1643 0          MP      AMGB7
0789  REF   6  LAST  993   21,3212  55=500 1          TS      AK2
0790  REF   4  LAST  993   21,3213  3 1514 0          CA      WTEMP +1
0791                       21,3214  0 0006 1          EXTEND
0792  REF  16  LAST  986   21,3215  20 034 1          MSU     CDUZ
0793  REF  14  LAST  994   21,3216  55=502 0          TS      T5TEMP
0794                       21,3217  0 0006 1          EXTEND
0795  REF   3  LAST  976   21,3220  7 1642 1          MP      AMGB5
0796  REF   6  LAST  994   21,3221  27=477 0          ADS     AK1
0797  REF  15  LAST  994   21,3222  3 1502 1          CA      T5TEMP
0798                       21,3223  0 0006 1          EXTEND
0799  REF   3  LAST  976   21,3224  7 1644 1          MP      AMGB8
0800  REF   7  LAST  994   21,3225  27=500 1          ADS     AK2
0801  REF  38  LAST  993   21,3226  1 5222 1          TCF     RESUME      END PHASE1 OF RCS DAP

0802                       21,3227  0 0006 1  WRTN17  EXTEND
0803  REF   9  LAST  587   21,3230  3 1335 0          DCA     CPHIX +1    GET SET TO COMPUTE TOTAL ASTRONAUT
0804  REF   5  LAST  994   21,3231  53=514 1          DXCH    WTEMP       ATTITUDE ERROR WRT N17 BY PICKING UP
0805  REF  10  LAST  994   21,3232  3 1333 0          CA      CPHIX       THE THREE COMPONENTS OF N17
0806  REF   1             21,3233  1 3171 1          TCF     GETAKS
```

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```
0001                          21,3234                    BANK   21
0002  REF   3  LAST  973      21,2000                    SETLOC DAPS3
0003                          21,3234                    BANK

0004  REF   1                                            COUNT  21/DAPAM

0005  REF  23  LAST  986      E6,1510                    EBANK= KMPAC
0006                          21,3234  0 0006 1  AHFNOROT EXTEND
0007  REF  10  LAST  989      21,3235  00 031 0          READ   CHAN31
0008  REF  59  LAST  989      21,3236  7 4675 0          MASK   BIT14
0009                          21,3237  0 0006 1          EXTEND
0010  REF   1                 21,3240  6 3256 0          BZMF   FREECONT
0011  REF  42  LAST  993      21,3241  3 1501 1          CA     RCSFLAGS     SEE IF RATE FILTER HAS BEEN INITIALIZED
0012  REF  60  LAST  996      21,3242  7 4675 0          MASK   BIT14
0013  REF 228  LAST  989      21,3243  10 000 0          CCS    A            IF SO, PROCEED WITH ATTITUDE CONTROL
0014  REF   3  LAST  989      21,3244  1 2520 0          TCF    REINIT       IF NOT, RECYCLE TO INITIALIZE FILTER
A0015                                                                       AUTOMATIC CONTROL YET
0016                          21,3245  0 0006 1          EXTEND
0017  REF  11  LAST  996      21,3246  00 031 0          READ   CHAN31
0018  REF  39  LAST  941      21,3247  7 4676 0          MASK   BIT13
0019                          21,3250  0 0006 1          EXTEND
0020  REF   1                 21,3251  6 3356 1          BZMF   HOLDFUNC
0021  REF  12  LAST  988      21,3252  3 1332 1  AUTOCONT CA     HOLDFLAG     IF HOLDFLAG IS +, GO TO GRABANG.
0022                          21,3253  0 0006 1          EXTEND              OTHERWISE, GO TO ATTHOLD.
0023  REF   1                 21,3254  6 3306 1          BZMF   ATTHOLD
0024  REF   1                 21,3255  1 3362 1          TCF    GRABANG

R0026          MINIMUM IMPULSE CONTROL

0027  REF 106  LAST  989      21,3256  3 4712 1  FREECONT CAF    ONE
0028  REF  13  LAST  996      21,3257  55∝332 0          TS     HOLDFLAG     RESET HOLDFLAG
A0029                                                                       INHIBIT AUTOMATIC STEERING
0030                          21,3260  0 0006 1          EXTEND
0031  REF   2  LAST  132      21,3261  00 032 0          READ   CHAN32
0032  REF 128  LAST  988      21,3262  54 001 1          TS     L
0033                          21,3263  4 0000 0          COM
0034  REF   3  LAST  988      21,3264  7 3022 0          MASK   MANROT
0035  REF   3  LAST  985      21,3265  7 1633 1          MASK   CHANTEMP
0036  REF   4  LAST  996      21,3266  23∝633 0          LXCH   CHANTEMP
0037  REF   3  LAST  988      21,3267  0 3114 0          TC     STICKCHK
0038  REF   6  LAST  992      21,3270  51∝656 0          INDEX  RMANNDX
0039  REF   1                 21,3271  3 3302 0          CA     MINTAU       MINTAU  +0
0040  REF   3  LAST  991      21,3272  55∝561 0          TS     TAU                  +1   +14MS MINIMUM IMPULSE
0041  REF   5  LAST  992      21,3273  51∝657 1          INDEX  PMANNDX              +2   -14MS TIME
0042  REF   2  LAST  996      21,3274  3 3302 0          CA     MINTAU               +3   +0
0043  REF   3  LAST  991      21,3275  55∝562 0          TS     TAU1
0044  REF   5  LAST  992      21,3276  51∝660 0          INDEX  YMANNDX
0045  REF   3  LAST  996      21,3277  3 3302 0          CA     MINTAU
```

```
0046  REP  3 LAST  991    21,3300  55=563 1          TS    TAU2
0047  REP  2 LAST  991    21,3301  1 3053 0          TCF   T6PROGM
0048                      21,3302   00000 1  MINTAU  DEC   0
0049                      21,3303   00027 1          DEC   23          = 14MS
0050                      21,3304   77750 0          DEC   -23         = -14MS
0051                      21,3305   00000 1          DEC   0
```

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P0052 CALCULATION OF ATTITUDE ERRORS-

R0053 - * - - -
R0054 AK = AMGB (CDUX - THETADX) + BIAS

R0055 IE *AK * * 1 SIN(PSI) 0 ** CDUX - THETADX * *BIAS *
R0057 * * * ** * * *
R0059 *AK1* = * 0 COS(PSI)COS(PHI) SIN(PHI)** CDUY - THETADY * + *BIAS1*
R0061 * * * ** * * *
R0063 *AK2* * 0 -COS(PSI)SIN(PHI) COS(PHI)** CDUZ - THETADZ * *BIAS2*
R0065 THE BIASES ARE ADDED ONLY WHILE PERFORMING AUTOMATIC MANEUVERS (ESP KALCMANU) TO PROVIDE ADDITIONAL LEAD
R0067 AND PREVENT OVERSHOOT WHEN STARTING AN AUTOMATIC MANEUVER. NORMALLY THE REQUIRED LEAD IS ONLY 1-2 DEGREES.
R0069 BUT DURING HIGH RATE MANEUVERS IT CAN BE AS MUCH AS 7 DEGREES. THE BIASES ARE COMPUTED BY KALCMANU AND REMAIN
R0071 FIXED UNTIL THE MANEUVER IS COMPLETED AT WHICH TIME THEY ARE RESET TO ZERO.

```
0075  REF  23  LAST  993   21,3306  3 0032 0  ATTHOLD  CA      CDUX
0076                       21,3307  0 0006 1           EXTEND
0077  REF   6  LAST  979   21,3310  21∝572 1           MSU     THETADX
0078  REF   9  LAST  993   21,3311  55∝567 0           TS      ERRORX
0079  REF  14  LAST  993   21,3312  3 0033 1           CA      CDUY
0080                       21,3313  0 0006 1           EXTEND
0081  REF   3  LAST  643   21,3314  21∝573 0           MSU     THETADY
0082  REF  16  LAST  994   21,3315  55∝502 0           TS      T5TEMP
0083                       21,3316  0 0006 1           EXTEND
0084  REF   4  LAST  993   21,3317  7 1640 0           MP      AMGB1
0085  REF  10  LAST  998   21,3320  27∝567 0           ADS     ERRORX
0086  REF  17  LAST  998   21,3321  3 1502 1           CA      T5TEMP
0087                       21,3322  0 0006 1           EXTEND
0088  REF   4  LAST  993   21,3323  7 1641 1           MP      AMGB4
0089  REF   5  LAST  991   21,3324  55∝570 0           TS      ERRORY
0090  REF  18  LAST  998   21,3325  3 1502 1           CA      T5TEMP
0091                       21,3326  0 0006 1           EXTEND
0092  REF   4  LAST  994   21,3327  7 1643 0           MP      AMGB7
0093  REF   5  LAST  993   21,3330  55∝571 1           TS      ERRORZ
0094  REF  17  LAST  994   21,3331  3 0034 0           CA      CDUZ
0095                       21,3332  0 0006 1           EXTEND
0096  REF   3  LAST  114   21,3333  21∝574 1           MSU     THETADZ
0097  REF  19  LAST  998   21,3334  55∝502 0           TS      T5TEMP
0098                       21,3335  0 0006 1           EXTEND
0099  REF   4  LAST  994   21,3336  7 1642 1           MP      AMGB5
0100  REF   6  LAST  998   21,3337  27∝570 0           ADS     ERRORY
0101  REF  20  LAST  998   21,3340  3 1502 1           CA      T5TEMP
0102                       21,3341  0 0006 1           EXTEND
0103  REF   4  LAST  994   21,3342  7 1644 1           MP      AMGB8
0104  REF   6  LAST  998   21,3343  27∝571 1           ADS     ERRORZ
0105  REF  14  LAST  996   21,3344  4 1332 0           CS      HOLDFLAG
0106                       21,3345  0 0006 1           EXTEND
```

```
0107  REP  2  LAST  990  21,3346  6 3425 1          BZMF  JETS
0108  REP  4  LAST  411  21,3347  3 1564 1          CA    BIAS      AD BIASES ONLY IF PERFORMING AUTOMATIC
0109  REP 11  LAST  998  21,3350  27"567 0          ADS   ERRORX
0110  REP  4  LAST  411  21,3351  3 1565 0          CA    BIAS1
0111  REP  7  LAST  998  21,3352  27"570 0          ADS   ERRORY
0112  REP  4  LAST  411  21,3353  3 1566 0          CA    BIAS2
0113  REP  7  LAST  998  21,3354  27"571 1          ADS   ERRORZ
0114  REP  3  LAST  999  21,3355  1 3425 0          TCF   JETS
0115  REP 15  LAST  998  21,3356  11"332 0 HOLDFUNC CCS   HOLDFLAG
0116                     21,3357  1 3362 1          TCF   +3
0117  REP  2  LAST  996  21,3360  1 3306 0          TCF   ATTHOLD
0118                     21,3361  1 3362 1          TCF   +1
0119  REP 182 LAST  993  21,3362  3 4714 1 GRABANG  CAF   ZERO      ZERO WBODYS AND BIASES
01191 REP  13 LAST  990  21,3363  55"525 0          TS    WBODY
01192 REP  14 LAST  999  21,3364  55"526 0          TS    WBODY +1
01193 REP  5  LAST  585  21,3365  55"527 1          TS    WBODY1
01194 REP  6  LAST  999  21,3366  55"530 1          TS    WBODY1 +1
01195 REP  6  LAST  585  21,3367  55"531 0          TS    WBODY2
01196 REP  7  LAST  999  21,3370  55"532 0          TS    WBODY2 +1
01197 REP  5  LAST  999  21,3371  55"564 0          TS    BIAS
01198 REP  5  LAST  999  21,3372  55"565 1          TS    BIAS1
01199 REP  5  LAST  999  21,3373  55"566 1          TS    BIAS2

0120  REP 43  LAST  996  21,3374  3 1501 1          CA    RCSFLAGS
01201 REP  4  LAST  990  21,3375  7 3023 1          MASK  OCT16000
012011                   21,3376  0 0006 1          EXTEND            IS RATE DAMPING COMPLETED
01202 REP  1             21,3377  1 3405 1          BZF   ENDDAMP      IF SO, GO TO ENDDAMP
01203 REP 183 LAST  999  21,3400  3 4714 1          CAF   ZERO        OTHERWISE, ZERO ERRORS
01204 REP 12  LAST  999  21,3401  55"567 0          TS    ERRORX
01205 REP  8  LAST  999  21,3402  55"570 0          TS    ERRORY
01206 REP  8  LAST  999  21,3403  55"571 1          TS    ERRORZ
01207 REP  4  LAST  999  21,3404  1 3425 0          TCF   JETS

01208 REP 16  LAST  999  21,3405  55"332 0 ENDDAMP  TS    HOLDFLAG  SET HOLDFLAG +0,
01209                    21,3406  0 0006 1          EXTEND
0121  REP 24  LAST  998  21,3407  3 0033 1          DCA   CDUX      PICK UP CDU ANGLES FOR ATTITUDE HOLD
01211 REP  7  LAST  998  21,3410  53"573 0          DXCH  THETADX   REFERENCES
01212 REP 18  LAST  998  21,3411  3 0034 0          CA    CDUZ
01213 REP  4  LAST  998  21,3412  55"574 1          TS    THETADZ
01214 REP  3  LAST  999  21,3413  1 3306 0          TCF   ATTHOLD
```

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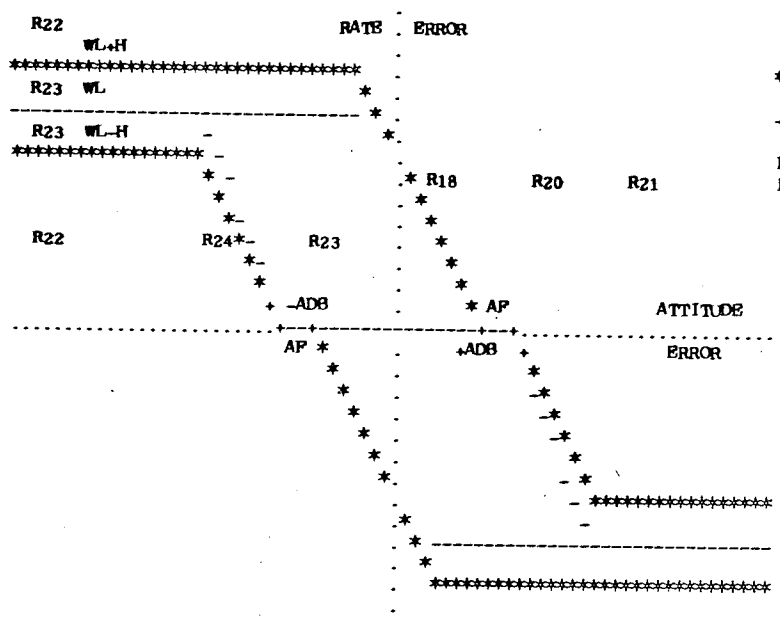
P0130 JET SWITCHING LOGIC AND CALCULATION OF REQUIRED ROTATION COMMANDS

R0131 DETERMINE THE LOCATION OF THE RATE ERROR AND THE ATTITUDE ERROR RELATIVE TO THE SWITCHING LOGIC IN THE PHASE
R0133 PLANE.
R0134 COMPUTE THE CHANGE IN RATE CORRESPONDING TO THE ATTITUDE ERROR NECESSARY TO DRIVE THE THE S/C INTO THE
R0136 APPROPRIATE DEADZONE.
R0137



***** SWITCH LINES ENCLOSING DEADZONES

----- DESIRED RATE LINES

R20, R21, R22, ETC REGIONS IN PHASE PLANE FOR COMPUTING DESIRED RESPONSE

R0170 FIG. 1 PHASE PLANE SWITCHING LOGIC
R0171 CONSTANTS FOR JET SWITCHING LOGIC

0172	21,3414	00114 0	WLH/SLOP	DEC	.00463	= WL+H/SLOPE = .83333 DEG		$180
0173	21,3415	00055 1	WL-H/SLP	DEC	.00277	= WL-H/SLOPE = .5 DEG		$180
0174	21,3416	00022 1	WLH	2DEC	.0011111111	= WL+H = 0.5 DEG/SEC		$450
0174	21,3417	06426 1						
0175	21,3420	00012 1	WLMH	2DEC	.0006666666	= WL-H = 0.3 DEG/SEC		$450
0175	21,3421	35415 1						
0176	21,3422	00016 0	WL	2DEC	.0008888888	= WL = 0.4 DEG/SEC		$450
0176	21,3423	22021 1						

```
0177                          21,3424   12173 1  SLOPE2  DEC    .32          = 0.8 DEG/SEC/DEG                $450/180
0178  REF   5  LAST  688      21,3425  3 1655 0  JETS    CA     ADB
0179  REF  13  LAST  987      21,3426  6 4710 0          AD     FOUR         AF = FLAT REGION = .044 DEG
0180  REF  21  LAST  998      21,3427  55∝502 0          TS     T5TEMP       ADB+AF
0181  REF  43  LAST  989      21,3430  3 4711 1          CAF    TWO
0182  REF  28  LAST  990      21,3431  55∝506 1  JLOOP   TS     SPNDX
0183                          21,3432  6 0000 1          DOUBLE
0184  REF  24  LAST  990      21,3433  55∝507 0          TS     DPNDX
0185                          21,3434  0 0006 1          EXTEND
0186  REF 229  LAST  996      21,3435  5 0000 1          INDEX  A
0187  REF   9  LAST  977      21,3436  3 1534 1          DCA    ADOT
0188  REF   2  LAST  106      21,3437  53∝516 0          DXCH   EDOT
0189  REF  17  LAST  999      21,3440  3 1332 1          CA     HOLDFLAG     HOLDFLAG = +0 MEANS THAT DAP IS IN
0190                          21,3441  0 0006 1          EXTEND               ATTITUDE HOLD AND RATE DAMPING IS OVER.
0191  REF   1                 21,3442  1 3447 1          BZF    INHOLD       IF THIS IS THE CASE, BYPASS ADDITION
A01911                                                                       OF WBODY AND GO TO INHOLD
0192                          21,3443  0 0006 1          EXTEND
0193  REF  25  LAST 1001      21,3444  5 1507 1          INDEX  DPNDX
0194  REF  15  LAST  999      21,3445  4 1526 0          DCS    WBODY
0195  REF   3  LAST 1001      21,3446  21∝516 0          DAS    EDOT         = ADOT-WBODY
0196  REF  29  LAST 1001      21,3447  51∝506 0  INHOLD  INDEX  SPNDX
0197  REF  13  LAST  999      21,3450  3 1567 1          CA     ERRORX
0198  REF   2  LAST  106      21,3451  55∝517 1          TS     AERR         AERR = BIAS + AK

0199  REF   4  LAST 1001      21,3452  11∝515 0          CCS    EDOT
0200  REF   1                 21,3453  1 3463 1          TCF    POSVEL
0201  REF   1                 21,3454  1 3456 1          TCF    SIGNCK1
0202  REF   1                 21,3455  1 3473 0          TCF    NEGVEL
0203  REF   5  LAST 1001      21,3456  11∝516 0  SIGNCK1 CCS    EDOT +1
0204  REF   2  LAST 1001      21,3457  1 3463 1          TCF    POSVEL
0205  REF   3  LAST 1001      21,3460  1 3463 1          TCF    POSVEL
0206  REF   2  LAST 1001      21,3461  1 3473 0          TCF    NEGVEL
0207  REF   3  LAST 1001      21,3462  1 3473 0          TCF    NEGVEL
0208                          21,3463  0 0006 1  POSVEL  EXTEND
0209  REF   6  LAST 1001      21,3464  3 1516 1          DCA    EDOT
0210  REF   2  LAST  106      21,3465  53∝521 1          DXCH   EDOTVEL
0211  REF  22  LAST 1001      21,3466  3 1502 1          CA     T5TEMP
0212  REF   1                 21,3467  55∝523 0          TS     ADBVEL       +(ADB+AF)
0213  REF   3  LAST 1001      21,3470  3 1517 0          CA     AERR
0214  REF   2  LAST  106      21,3471  55∝522 1          TS     AERRVEL
0215  REF   1                 21,3472  0 3502 0          TC     J6.
0216                          21,3473  0 0006 1  NEGVEL  EXTEND
0217  REF   7  LAST 1001      21,3474  4 1516 0          DCS    EDOT
0218  REF   3  LAST 1001      21,3475  53∝521 1          DXCH   EDOTVEL
0219  REF  23  LAST 1001      21,3476  4 1502 0          CS     T5TEMP
0220  REF   2  LAST 1001      21,3477  55∝523 0          TS     ADBVEL       -(ADB+AF)
0221  REF   4  LAST 1001      21,3500  4 1517 1          CS     AERR
0222  REF   3  LAST 1001      21,3501  55∝522 1          TS     AERRVEL

0223                          21,3502  0 0006 1  J6.     EXTEND
```

```
REF   6  LAST 1001   21,3503  61∝655 0          SU     ADB
REF   1              21,3504  6 3414 0          AD     WLH/SLOP
                     21,3505  0 0006 1          EXTEND
REF   1              21,3506  6 3535 1          BZMF   J8

REF  24  LAST 1001   21,3507  4 1502 0          CS     T5TEMP        (ADB+AF)
REF   4  LAST 1001   21,3510  6 1522 0          AD     AERRVEL
                     21,3511  0 0006 1          EXTEND
                     21,3512  6 3514 1          BZMF   +2
REF   1              21,3513  1 3526 1          TCF    J7
                     21,3514  0 0006 1          EXTEND
REF   4  LAST 1001   21,3515  4 1521 1          DCS    EDOTVEL
                     21,3516  0 0006 1          EXTEND
REF   3  LAST  985   21,3517  11∝654 0          DV     SLOPE
                     21,3520  0 0006 1          EXTEND
REF   5  LAST 1002   21,3521  61∝522 0          SU     AERRVEL
REF   7  LAST 1002   21,3522  6 1655 0          AD     ADB
                     21,3523  0 0006 1          EXTEND
REF   1              21,3524  6 3614 1          BZMF   J18
REF   1              21,3525  1 3670 1          TCF    J23

REF   1              21,3526  4 3415 0  J7      CS     WL-H/SLP
                     21,3527  0 0006 1          EXTEND
REF  25  LAST 1002   21,3530  61∝502 1          SU     T5TEMP        (ADB+AF)
REF   6  LAST 1002   21,3531  6 1522 0          AD     AERRVEL
                     21,3532  0 0006 1          EXTEND
REF   1              21,3533  6 3620 0          BZMF   J20
REF   1              21,3534  1 3631 1          TCF    J21

                     21,3535  0 0006 1  J8      EXTEND
REF   1              21,3536  4 3417 1          DCS    WLH
REF   6  LAST  994   21,3537  53∝514 1          DXCH   WTEMP
                     21,3540  0 0006 1          EXTEND
REF   5  LAST 1002   21,3541  3 1521 0          DCA    EDOTVEL
REF   7  LAST 1002   21,3542  21∝514 1          DAS    WTEMP
REF   8  LAST 1002   21,3543  11∝513 0          CCS    WTEMP
REF   1              21,3544  1 3657 1          TCF    J22
REF   1              21,3545  1 3547 0          TCF    SIGNCK2
REF   1              21,3546  1 3553 0          TCF    NJ22
REF   9  LAST 1002   21,3547  11∝514 1  SIGNCK2 CCS    WTEMP +1
REF   2  LAST 1002   21,3550  1 3657 1          TCF    J22
REF   3  LAST 1002   21,3551  1 3657 1          TCF    J22
REF   2  LAST 1002   21,3552  1 3553 0          TCF    NJ22

                     21,3553  0 0006 1  NJ22    EXTEND
REF   6  LAST 1002   21,3554  3 1521 0          DCA    EDOTVEL
                     21,3555  0 0006 1          EXTEND
REF   4  LAST 1002   21,3556  11∝654 0          DV     SLOPE
REF  26  LAST 1002   21,3557  6 1502 1          AD     T5TEMP        (ADB+AF)
REF   7  LAST 1002   21,3560  6 1522 0          AD     AERRVEL
```

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0270   REP 230  LAST 1001   21,3561  10 000 0          CCS   A
0271   REP   2  LAST 1002   21,3562  1 3670 1          TCF   J23
0272   REP   3  LAST 1003   21,3563  1 3670 1          TCF   J23
0273                        21,3564  1 3566 0          TCF   +2
0274   REP   4  LAST 1003   21,3565  1 3670 1          TCF   J23

0275                        21,3566  0 0006 1          EXTEND
0276   REP   1               21,3567  4 3421 1          DCS   WLMH          WL - H
0277   REP  10  LAST 1002   21,3570  53=514 1          DXCH  WTEMP
0278                        21,3571  0 0006 1          EXTEND
0279   REP   7  LAST 1002   21,3572  3 1521 0          DCA   EDOTVEL
0280   REP  11  LAST 1003   21,3573  21=514 1          DAS   WTEMP
0281   REP  12  LAST 1003   21,3574  11=513 0          CCS   WTEMP
0282   REP   5  LAST 1003   21,3575  1 3670 1          TCF   J23
0283   REP   1               21,3576  1 3600 0          TCF   SIGNCK3
0284   REP   1               21,3577  1 3604 1          TCF   NJ23
0285   REP  13  LAST 1003   21,3600  11=514 1  SIGNCK3  CCS   WTEMP +1
0286   REP   6  LAST 1003   21,3601  1 3670 1          TCF   J23
0287   REP   7  LAST 1003   21,3602  1 3670 1          TCF   J23
0288   REP   2  LAST 1003   21,3603  1 3604 1          TCF   NJ23

0289   REP   8  LAST 1002   21,3604  3 1522 0  NJ23    CA    AERRVEL
0290   REP  27  LAST 1002   21,3605  6 1502 1          AD    T5TEMP        (ADB+AP)
0291   REP   2  LAST 1002   21,3606  6 3415 1          AD    WL-H/SLP
0292   REP 231  LAST 1003   21,3607  10 000 0          CCS   A
0293   REP   1               21,3610  1 3702 0          TCF   J24
0294   REP   2  LAST 1003   21,3611  1 3702 0          TCF   J24
0295   REP   4  LAST 1002   21,3612  1 3657 1          TCF   J22
0296   REP   5  LAST 1003   21,3613  1 3657 1          TCF   J22

0297                        21,3614  0 0006 1  J18     EXTEND
0298   REP   8  LAST 1001   21,3615  4 1516 0          DCS   EDOT
0299   REP  24  LAST  996   21,3616  53=511 1          DXCH  KMPAC
0300   REP   1               21,3617  1 3713 0          TCF   JTIME

0301   REP   5  LAST 1001   21,3620  4 1517 1  J20     CS    AERR
0302   REP   3  LAST 1001   21,3621  6 1523 1          AD    ADBVEL
0303                        21,3622  0 0006 1          EXTEND
0304   REP   1               21,3623  7 3424 1          MP    SLOPE2        (HYSTERESIS SLOPE)
0305   REP  25  LAST 1003   21,3624  53=511 1          DXCH  KMPAC
0306                        21,3625  0 0006 1          EXTEND
0307   REP   9  LAST 1003   21,3626  4 1516 0          DCS   EDOT
0308   REP  26  LAST 1003   21,3627  21=511 1          DAS   KMPAC
0309   REP   2  LAST 1003   21,3630  1 3713 0          TCF   JTIME

0310   REP  10  LAST 1003   21,3631  11=515 0  J21     CCS   EDOT
0311   REP   1               21,3632  1 3650 0          TCF   JP
0312   REP   1               21,3633  1 3635 0          TCF   SIGNCK4
0313   REP   1               21,3634  1 3641 0          TCF   JN
0314   REP  11  LAST 1003   21,3635  11=516 0  SIGNCK4  CCS   EDOT +1
```

```
0315   REF   2  LAST 1003   21,3636  1 3650 0          TCF   JP
0316   REF   3  LAST 1004   21,3637  1 3650 0          TCF   JP
0317   REF   2  LAST 1003   21,3640  1 3641 0          TCF   JN
0318                        21,3641  0 0006 1  JN      EXTEND
0319   REF  12  LAST 1003   21,3642  4 1516 0          DCS   EDOT
0320   REF  27  LAST 1003   21,3643  53=511 1          DXCH  KMPAC
0321                        21,3644  0 0006 1          EXTEND
0322   REF   1              21,3645  3 3423 1          DCA   WL
0323   REF  28  LAST 1004   21,3646  21=511 1          DAS   KMPAC
0324   REF   3  LAST 1003   21,3647  1 3713 0          TCF   JTIME

0325                        21,3650  0 0006 1  JP      EXTEND
0326   REF  13  LAST 1004   21,3651  4 1516 0          DCS   EDOT
0327   REF  29  LAST 1004   21,3652  53=511 1          DXCH  KMPAC
0328                        21,3653  0 0006 1          EXTEND
0329   REF   2  LAST 1004   21,3654  4 3423 0          DCS   WL
0330   REF  30  LAST 1004   21,3655  21=511 1          DAS   KMPAC
0331   REF   4  LAST 1004   21,3656  1 3713 0          TCF   JTIME

0332   REF  14  LAST 1004   21,3657  11=515 0  J22     CCS   EDOT
0333   REF   3  LAST 1004   21,3660  1 3641 0          TCF   JN
0334   REF   1              21,3661  1 3663 0          TCF   SIGNCK5
0335   REF   4  LAST 1004   21,3662  1 3650 0          TCF   JP
0336   REF  15  LAST 1004   21,3663  11=516 0  SIGNCK5  CCS   EDOT +1
0337   REF   4  LAST 1004   21,3664  1 3641 0          TCF   JN
0338   REF   5  LAST 1004   21,3665  1 3641 0          TCF   JN
0339   REF   5  LAST 1004   21,3666  1 3650 0          TCF   JP
0340   REF   6  LAST 1004   21,3667  1 3650 0          TCF   JP

0341   REF  30  LAST 1001   21,3670  51=506 0  J23     INDEX SPNDX
034151 REF  40  LAST  996   21,3671  4 4676 0          CS    BIT13       RESET RATE DAMPING FLAG
034152 REF  44  LAST  999   21,3672  7 1501 0          MASK  RCSFLAGS    BIT13 FOR ROLL  (SPNDX = 0)
034153 REF  45  LAST 1004   21,3673  55=501 0          TS    RCSFLAGS    BIT12 FOR PITCH (SPNDX = 1)
A034154                                                                 BIT11 FOR YAW   (SPNDX = 2)

034155 REF  31  LAST 1004   21,3674  51=506 0          INDEX SPNDX
034156 REF   1              21,3675  3 3017 1          CAF   OCT01400    IS THERE TO BE A FORCED FIRING ON THIS
034157 REF  46  LAST 1004   21,3676  7 1501 0          MASK  RCSFLAGS    AXIS
034158                      21,3677  0 0006 1          EXTEND
034159 REF   1              21,3700  1 3734 0          BZF   DOJET +2    NO, GO TO DOJET +2 AND DO NOTHING

03416  REF   2  LAST 1002   21,3701  1 3614 0          TCF   J18         YES, GO TO J18 AND FORCE A FIRING

0342   REF   6  LAST 1003   21,3702  4 1517 1  J24     CS    AERR
0343                        21,3703  0 0006 1          EXTEND
0344   REF   4  LAST 1003   21,3704  61=523 1          SU    ADSVEL
0345                        21,3705  0 0006 1          EXTEND
0346   REF   2  LAST 1003   21,3706  7 3424 1          MP    SLOPE2      (HYSTERESIS SLOPE)
0347   REF  31  LAST 1004   21,3707  53=511 1          DXCH  KMPAC
0348                        21,3710  0 0006 1          EXTEND
```

```
0349   REF  16  LAST 1004   21,3711  4 1516 0          DCS    EDOT
0350   REF  32  LAST 1004   21,3712  21=511 1          DAS    KMPAC
```

```
P0351        COMPUTE THE JET ON TIME NECESSARY TO ACCOMPLISH THE DESIRED CHANGE IN RATE, IE

R0353              T  = J/M(DELTA W)
R0354               J

R0355       DELTA W = DESIRED CHANGE IN S/C ANGULAR RATE AS DETERMINED BY THE
R0356                 SWITCHING LOGIC,  AT THIS POINT STORED IN KMPAC.

R0357           J/M  = S/C INERTIA TO TORQUE RATIO  SCALED BY
R0358                  (57.3/450)(B24/1600)(1/.8)
R0359                FOR 1 JET OPERATION  (M = 700 FT-LB).
R0360                IE  J/M = J(SLUG-FTFT) X 0.00000085601606

R0361                THE CORRESPONDING COMPUTER VARIABLES ESTABLISHED BY
R0362                KEYBOARD ENTRY ARE
R0363                   J/M (ROLL)
R0364                   J/M1 (PITCH)
R0365                   J/M2 (YAW)

R0366            T  = JET ON-TIME      SCALED 16384/1600 SEC
R0367             J

R0368                THE COMPUTER VARIABLES ARE
R0369                   TAU  (ROLL)
R0370                   TAU1 (PITCH)
R0371                   TAU2 (YAW)
 0372   REF  32  LAST 1004   21,3713  51=506 0  JTIME    INDEX  SPNDX     PICK UP S/C INERTIA/TORQUE RATIO
 0373   REF   3  LAST  691   21,3714  3 1623 1           CA     J/M       SCALED (57.3/450)(B24/1600)
 0374   REF   2  LAST  976   21,3715  0 2026 1           TC     SMALLMP   FOR 1-JET OPERATION
 0375   REF  29  LAST  955   21,3716  3 4700 1           CA     BIT11
 0376   REF   3  LAST 1006   21,3717  0 2026 1           TC     SMALLMP
 0377   REF  33  LAST 1005   21,3720  11=510 0           CCS    KMPAC
 0378                        21,3721  1 3725 0           TCF    +4
 0379   REF   1              21,3722  1 3731 0           TCF    TAUNORM
 0380                        21,3723  1 3727 1           TCF    +4
 0381   REF   2  LAST 1006   21,3724  1 3731 0           TCF    TAUNORM
 0382   REF  26  LAST  973   21,3725  3 4672 0           CA     POSMAX
 0383   REF   2  LAST 1004   21,3726  1 3732 0           TCF    DOJET
 0384   REF   8  LAST  971   21,3727  3 4674 0           CA     NEGMAX
 0385   REF   3  LAST 1006   21,3730  1 3732 0           TCF    DOJET

 0386   REF  34  LAST 1006   21,3731  3 1511 0  TAUNORM  CA     KMPAC +1
 0387   REF  33  LAST 1006   21,3732  51=506 0  DOJET    INDEX  SPNDX
 0388   REF   4  LAST  996   21,3733  55=561 0           TS     TAU
 0389   REF  34  LAST 1006   21,3734  11=506 1           CCS    SPNDX
 0390   REF   1              21,3735  1 3431 0           TCF    JLOOP
 0391   REF   2  LAST  991   21,3736  1 3743 0           TCF    T6PROG
```

```
0392  REP 184  LAST  999   21,3737  3 4714 1  ZEROCMDS CAF    ZERO
0393  REP   5  LAST 1006   21,3740  55=561 0           TS     TAU
0394  REP   4  LAST  998   21,3741  55=562 0           TS     TAU1
0395  REP   4  LAST  997   21,3742  55=563 1           TS     TAU2
0396                       21,3743  0 0006 1  T6PROG   EXTEND
0397  REP   1              21,3744  3 3750 0           DCA    JETADDR
0398  REP  20  LAST  973   21,3745  53=313 0           DXCH   T5LOC
0399  REP  39  LAST  994   21,3746  1 5222 1           TCF    RESUME

0400  REP  35  LAST 1006   E6,1510                     EBANK= KMPAC
0401  REP   1              21,3747   02577 0  JETADDR 2CADR  JETSLECT
0401  REP   1              21,3750   38066 1
```

WHEN THE ROTATION COMMANDS (TAUS)
HAVE BEEN DETERMINED
RESET T5LOC FOR PHASE3

```
R0001   CALCULATION OF  AMGB, AMBG      ONCE EVERY SECOND

R0002    AMGB =  1   SIN(PSI)              0
R0003            0   COS(PSI)COS(PHI)      SIN(PHI)
R0004            0   -COS(PSI)SIN(PHI)     COS(PHI)
R0005
R0006    AMBG =  1   -TAN(PSI)COS(PHI)     TAN(PSI)SIN(PHI)
R0007            0   COS(PHI)/COS(PSI)     -SIN(PHI)/COS(PSI)
R0008            0   SIN(PHI)              COS(PHI)
R0009
R0010    WHERE PHI AND PSI ARE CDU ANGLES
R0011
R0012
 0013                        20,3565                    BANK   20
 0014   REF   1             22,2000                    SETLOC DAPS8
 0015                        22,3444                    BANK

 0016   REF   1                                        COUNT* $$/DAPEX
 0017   REF  36  LAST 1007  E6,1510                    EBANK= KMPAC
 0018   REF  26  LAST  904  22,3444  3 0102 1  AMBGUPDT CA     FLAGWRD6     CHECK FOR RCS AUTOPILOT
 0019                        22,3445  0 0006 1          EXTEND
 0020   REF 105  LAST  945  22,3446  6 5112 0          BZMF   ENDOFJOB     BIT15 = 0, BIT14 = 1
 0021   REF  61  LAST  996  22,3447  7 4675 0          MASK   BIT14        IF NOT RCS, EXIT
 0022                        22,3450  0 0006 1          EXTEND
 0023   REF 106  LAST 1008  22,3451  1 5112 1          BZF    ENDOFJOB     TO PROTECT TVC DAP ON SWITCHOVER

 0024   REF  19  LAST  999  22,3452  3 0034 0          CA     CDUZ
 0025   REF   1             22,3453  0 4770 0          TC     SPSIN2
 0026   REF   5  LAST  998  22,3454  55∝640 0          TS     AMGB1        CALCULATE AMGB
 0027   REF  20  LAST 1008  22,3455  3 0034 0          CA     CDUZ
 0028   REF   1             22,3456  0 4767 0          TC     SPCOS2
 0029   REF   2  LAST  108  22,3457  55∝645 0          TS     CAPSI        MUST CHECK FOR GIMBAL LOCK
 0030   REF   1             22,3460  3 3504 0          CAF    QUADANGL     = 7.25  DEGREES JET QUAD ANGULAR OFFSET
 0031                        22,3461  0 0006 1          EXTEND
 0032   REF  25  LAST  999  22,3462  20 032 1          MSU    CDUX
 0033                        22,3463  4 0000 0          COM                 CDUX - 7.25 DEG
 0034   REF   1             22,3464  0 4767 0          TC     SPCOS1
 0035   REF   5  LAST  998  22,3465  55∝644 1          TS     AMGB8
 0036                        22,3466  0 0006 1          EXTEND
 0037   REF   3  LAST 1008  22,3467  7 1645 0          MP     CAPSI
 0038   REF   5  LAST  998  22,3470  55∝641 1          TS     AMGB4
 0039   REF   2  LAST 1008  22,3471  3 3504 0          CAF    QUADANGL
 0040                        22,3472  0 0006 1          EXTEND
 0041   REF  26  LAST 1008  22,3473  20 032 1          MSU    CDUX
 0042                        22,3474  4 0000 0          COM                 CDUX - 7.25 DEG
 0043   REF   1             22,3475  0 4770 0          TC     SPSIN1
 0044   REF   5  LAST  998  22,3476  55∝642 1          TS     AMGB5
 0045                        22,3477  0 0006 1          EXTEND
 0046   REF   4  LAST 1008  22,3500  7 1645 0          MP     CAPSI
 0047                        22,3501  4 0000 0          COM
```

```
0048  REF   5  LAST  998    22,3502  55=643 0          TS      AMGB7
0049  REF 107  LAST 1008    22,3503  1 5112 1          TCF     ENDOFJOB
0050                        22,3504   01224 1 QUADANGL DEC     660          = 7.25 DEGREES
```

```
0001                          21,3751                    BANK   21
0002  REF   2  LAST  963      17,2000                    SETLOC DAPS4
0003                          17,2577                    BANK

0004  REF   1                                            COUNT  17/DAPJS

0005  REF  37  LAST 1008      E6,1510                    EBANK= KMPAC
R0006  EXAMINE CHANNEL 31 FOR TRANSLATION COMMANDS

0007  REF  18  LAST  973      17,2577  22 016 0  JETSLECT LXCH   BANKRUPT
0008  REF   1                 17,2600  3 2661 1           CAF    DELTATT3     = 60 MS   RESET TO EXECUTE PHASE1
0009  REF   6  LAST  992      17,2601  6 1634 1           AD     T5TIME
0010  REF  23  LAST  993      17,2602  54 030 0           TS     TIME5
0011                          17,2603  1 2606 1           TCF    +3
0012  REF   1                 17,2604  3 2662 1           CAF    DELATT20     = 20 MS   TO ASSURE A T5RUPT
0013  REF  24  LAST 1010      17,2605  54 030 0           TS     TIME5
0014  REF   1                 17,2606  3 3340 0           CAF    =14MS        RESET T6 TO INITIALIZE THE JET CHANNELS
0015  REF   4  LAST  987      17,2607  54 031 1           TS     TIME6        IN 14 MS
0016  REF   9  LAST 1006      17,2610  3 4674 0           CAF    NEGMAX
0017                          17,2611  0 0006 1           EXTEND
0018  REF  10  LAST  987      17,2612  05 013 0           WOR    CHAN13
0019                          17,2613  0 0006 1           EXTEND
0020  REF  14  LAST  973      17,2614  22 012 1           QXCH   QRUPT
0021  REF   1                 17,2615  3 2660 0           CAF    XLNMASK      = 7700 OCT
0022                          17,2616  0 0006 1           EXTEND              EXAMINE THE TRANSLATION
0023  REF  12  LAST  996      17,2617  06 031 0           RXOR   CHAN31       HAND CONTROLLER
0024  REF   2  LAST 1010      17,2620  7 2660 1           MASK   XLNMASK
0025                          17,2621  0 0006 1           EXTEND
0026  REF   1                 17,2622  1 2663 1           BZF    NOXLNCMD
0027  REF  28  LAST 1003      17,2623  55∝502 0           TS     T5TEMP
0028                          17,2624  0 0006 1           EXTEND
0029  REF  31  LAST  993      17,2625  7 4702 1           MP     BIT9
0030  REF  30  LAST  992      17,2626  7 6214 1           MASK   THREE
0031  REF   3  LAST  106      17,2627  55∝513 0           TS     XNDX1        AC QUAD  X-TRANSLATION INDEX
0032  REF   2  LAST  106      17,2630  55∝514 1           TS     XNDX2        BD QUAD  X-TRANSLATION INDEX
0033  REF  29  LAST 1010      17,2631  3 1502 1           CA     T5TEMP
0034                          17,2632  0 0006 1           EXTEND              1 = + XLN
0035  REF  44  LAST  990      17,2633  7 4704 1           MP     BIT7         2 = - XLN
0036  REF  31  LAST 1010      17,2634  7 6214 1           MASK   THREE        3 = NO XLN
0037  REF   3  LAST  106      17,2635  55∝515 0           TS     YNDX         Y-TRANSLATION INDEX

0038  REF  30  LAST 1010      17,2636  3 1502 1           CA     T5TEMP
0039                          17,2637  0 0006 1           EXTEND
0040  REF  36  LAST  988      17,2640  7 4706 0           MP     BIT5
0041  REF  32  LAST 1010      17,2641  7 6214 1           MASK   THREE
0042  REF   2  LAST  106      17,2642  55∝516 0           TS     ZNDX         Z-TRANSLATION INDEX

0043  REF  70  LAST  932      17,2643  3 1466 1           CA     DAPDATR1     SET ATTKALMN TO PICK UP FILTER GAINS FOR
00432 REF  62  LAST 1008      17,2644  7 4675 0           MASK   BIT14        TRANSLATIONS.
00434                         17,2645  0 0006 1           EXTEND              CHECK DAPDATR1 BIT 14 FOR LEM ATTACHED.
```

L JET SELECTION LOGIC USER=S PAGE NO. 2 E6 S3

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00436  REF   1                17,2646  1 2651 0          BZF   NOLEM
00438  REF  33  LAST 1010     17,2647  4 6214 1          CS    THREE      IF LEM IS ON, SET ATTKALMN = -3
0044                          17,2650  1 2652 0          TCF   +2
00442  REF  44  LAST 1001     17,2651  4 4711 0  NOLEM   CS    TWO        IF LEM IS OFF, SET ATTKALMN = -2.
00444  REF  10  LAST  992     17,2652  55=617 1          TS    ATTKALMN
0045   REF   4  LAST  688     17,2653  11=631 0          CCS   XTRANS     (+, -1, 0)
0046   REF   4  LAST 1010     17,2654  55=513 0          TS    XNDX1      USING BD-X  ZERO XNDX1
0047   REF   1                17,2655  1 2667 0          TCF   PWORD
0048   REF   3  LAST 1010     17,2656  55=514 1          TS    XNDX2      USING AC-X  ZERO XNDX2
0049   REF   2  LAST 1011     17,2657  1 2667 0          TCF   PWORD
0050                          17,2660   07700 1  XLNMASK OCT   7700
0051                          17,2661   37772 1  DELTATT3 DEC   16378      = 60 MS
0052                          17,2662   37776 0  DELATT20 DEC   16382      = 20 MS

0053   REF   5  LAST 1011     17,2663  55=513 0  NOXLNCMD TS    XNDX1      ZERO ALL REQUESTS FOR TRANSLATION
0054   REF   4  LAST 1011     17,2664  55=514 1          TS    XNDX2
0055   REF   4  LAST 1010     17,2665  55=515 0          TS    YNDX
0056   REF   3  LAST 1010     17,2666  55=516 0          TS    ZNDX

R0057  PITCH COMMANDS  TIMING(NO X-TRANS, NO QUAD FAILS) 32MCT

0058   REF   5  LAST 1007     17,2667  11=562 0  PWORD   CCS   TAU1       CHECK FOR PITCH COMMANDS
0059   REF 107  LAST  996     17,2670  3 4712 1          CAF   ONE
0060                          17,2671  1 2673 0          TCF   +2          0 = NO PITCH
0061   REF  45  LAST 1011     17,2672  3 4711 1          CAF   TWO        +1 =  + PITCH
0062   REF   2  LAST  106     17,2673  55=520 0          TS    PINDEX     +2 =  - PITCH

0063   REF   5  LAST  689     17,2674  11=626 0          CCS   RACFAIL    FLAG FOR REAL AC QUAD FAILURES
0064   REF   1                17,2675  1 2701 1          TCF   AFAILP
0065   REF   1                17,2676  1 2711 0          TCF   TABPCOM    0 = NO REAL AC FAILURES
0066   REF   1                17,2677  1 2703 0          TCF   CFAILP     + = A QUAD FAILED
0067   REF   2  LAST 1011     17,2700  1 2711 0          TCF   TABPCOM    - = C QUAD FAILED
A0068                                                                     IF FAILURES ARE PRESENT IGNORE
A0069                                                                     X-TRANSLATIONS ON THIS AXIS

0070   REF   5  LAST  977     17,2701  3 4334 1  AFAILP  CAF   NINE       IF FAILURE IS PRESENT 1JET OPERATION
0071   REF   3  LAST 1011     17,2702  1 2713 1          TCF   TABPCOM +2  IS ASSUMED. IGNORE X-TRANSLATION
0072   REF   2  LAST  824     17,2703  3 5656 1  CFAILP  CAF   TWELVE
0073   REF   4  LAST 1011     17,2704  1 2713 1          TCF   TABPCOM +2

0074                          17,2705   00000 1  XLNNDX  DEC   0          INDECES FOR TRANSLATION COMMANDS
0075                          17,2706   00003 1          DEC   3          FOR USE IN TABLE LOOK UP
0076                          17,2707   00006 1          DEC   6
0077                          17,2710   00000 1          DEC   0

0078   REF   3  LAST  712       5656            TWELVE  =     OCT14
R0079  TABLE LOOK UP FOR PITCH COMMANDS WITH AND WITHOUT X-TRANSLATION AND AC QUAD FAILURES PRESENT.
R0081  BITS 9, 10 CONTAIN THE NUMBER OF PITCH JETS USED TO PERFORM THE PITCH ROTATION
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L JET SELECTION LOGIC


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0083  REF   6  LAST 1011   17,2711  51*513 1  TABPCOM  INDEX  XNDX1
0084  REF   1              17,2712  3 2705 1           CA     XLNNDX
0085  REF   3  LAST 1011   17,2713  6 1520 1           AD     PINDEX
0086  REF 232  LAST 1003   17,2714  50 000 1           INDEX  A
0087  REF   1              17,2715  3 2741 1           CA     PYTABLE
0088  REF   1              17,2716  7 2760 0           MASK   PJETS      =1417 OCT
0089  REF   2  LAST  100   17,2717  55*453 0           TS     PWORD1
0090                       17,2720  0 0006 1           EXTEND
0091  REF  45  LAST 1010   17,2721  7 4704 1           MP     BIT7
0092  REF   2  LAST  106   17,2722  55*523 0           TS     NPJETS     = NO. OF PITCH JETS

R0093  YAW JET COMMANDS  TIMING(NO X-TRANS, NO QUAD FAILURES)  32MCT

0094  REF   5  LAST 1007   17,2723  11*563 1  YWORD    CCS    TAU2       CHECK FOR YAW COMMANDS
0095  REF 108  LAST 1011   17,2724  3 4712 1           CAF    ONE
0096                       17,2725  1 2727 0           TCF    +2
0097  REF  46  LAST 1011   17,2726  3 4711 1           CAF    TWO
0098  REF   2  LAST  106   17,2727  55*521 1           TS     YINDEX     YAW ROTATION INDEX

0099  REF   5  LAST  689   17,2730  11*627 1           CCS    RBDFAIL    FLAG FOR B OR D QUAD FAILURES
0100  REF   1              17,2731  1 2735 0           TCF    BFAILY     0  = NO BD FAILURE
0101  REF   1              17,2732  1 2762 1           TCF    TABYCOM    +  = B QUAD FAILED
0102  REF   1              17,2733  1 2737 1           TCF    DFAILY     -  = D QUAD FAILED
0103  REF   2  LAST 1012   17,2734  1 2762 1           TCF    TABYCOM

0104  REF   6  LAST 1011   17,2735  3 4334 1  BFAILY   CAF    NINE
0105  REF   3  LAST 1012   17,2736  1 2764 1           TCF    TABYCOM +2
0106  REF   3  LAST 1011   17,2737  3 5656 1  DFAILY   CAF    TWELVE
0107  REF   4  LAST 1012   17,2740  1 2764 1           TCF    TABYCOM +2
```

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P0108   TABLE FOR PITCH(YAW) COMMANDS
R0109   BITS 4,3,2,1 = PITCH, X-TRANSLATION JETS SELECTED
R0110   BITS     10,9 = NO. PITCH JETS USED TO PERFORM ROTATION
R0111   BITS 8,7,6,5 = YAW, X-TRANSLATION JETS SELECTED
R0112   BITS 12,11 ' NO. YAW JETS USED TO PERFORM ROTATION

A0113                                                                  ROT  TRANS  QUAD  BIAS
 0114                    17,2741   00000 1  PYTABLE  OCT    0           0     0            0
 0115                    17,2742   05125 1           OCT    5125        +     0            0
 0116                    17,2743   05252 1           OCT    5252        -     0            0
 0117                    17,2744   00231 1           OCT    0231        0     +            3
 0118                    17,2745   02421 1           OCT    2421        +     +            3
 0119                    17,2746   02610 1           OCT    2610        -     +            3
 0120                    17,2747   00146 1           OCT    0146        0     -            6
 0121                    17,2750   02504 1           OCT    2504        +     -            6
 0122                    17,2751   02442 1           OCT    2442        -     -            6
 0123                    17,2752   00000 1           OCT    0           0          A(B)    9
 0124                    17,2753   02421 1           OCT    2421        +          A(B)    9
 0125                    17,2754   02442 1           OCT    2442        -          A(B)    9
 0126                    17,2755   00000 1           OCT    0           0          C(D)    12
 0127                    17,2756   02504 1           OCT    2504        +          C(D)    12
 0128                    17,2757   02610 1           OCT    2610        -          C(D)    12

R0129   MASKS FOR PITCH AND YAW COMMANDS

 0130                    17,2760   01417 1  PJETS    OCT    1417
 0131                    17,2761   06360 1  YJETS    OCT    6360

R0132   TABLE LOOK UP FOR YAW COMMANDS WITH AND WITHOUT X-TRANSLATION AND AC QUAD FAILURES PRESENT
R0134   BITS 11, 12 CONTAIN THE NUMBER OF YAW JETS USED TO PERFORM THE YAW ROTATION

 0136   REF   5  LAST 1011  17,2762  51∝514 0  TABYCOM  INDEX  XNDX2
 0137   REF   2  LAST 1012  17,2763  3 2705 1           CA     XLNNDX
 0138   REF   3  LAST 1012  17,2764  6 1521 0           AD     YINDEX
 0139   REF 233  LAST 1012  17,2765  50 000 1           INDEX  A
 0140   REF   2  LAST 1012  17,2766  3 2741 1           CA     PYTABLE
 0141   REF   1             17,2767  7 2761 1           MASK   YJETS        = 6360 OCT
 0142   REF   2  LAST  100  17,2770  55∝455 0           TS     YWORD1
 0143                       17,2771  0 0006 1           EXTEND
 0144   REF  37  LAST 1010  17,2772  7 4706 0           MP     BIT5
 0145   REF   1             17,2773  55∝524 1           TS     NYJETS       NO. OF YAW JETS USED TO PERFORM ROTATION
```

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P0146   ROLL COMMANDS  TIMING(NO Y,Z TRANS, NO QUAD FAILS)  45MCT

 0147   REP   6  LAST 1007   17,2774  11=561 0  RWORD    CCS    TAU       CHECK FOR ROLL COMMANDS
 0148   REP 109  LAST 1012   17,2775  3 4712 1           CAF    ONE
 0149                       17,2776  1 3000 0           TCF    +2
 0150   REP  47  LAST 1012   17,2777  3 4711 1           CAF    TWO
 0151   REP   2  LAST  106   17,3000  55=517 1           TS     RINDEX

 0152   REP   3  LAST  689   17,3001  11=630 1           CCS    ACORBD    FLAG FOR AC OR BD QUAD SELECTION FOR
 0153   REP   1              17,3002  1 3073 1           TCF    BDROLL    ROLL COMMANDS
 0154   REP   2  LAST 1014   17,3003  1 3073 1           TCF    BDROLL    +, +0 = BD ROLL
 0155                       17,3004  1 3005 0           TCF    +1        -, -0 = AC ROLL

 0156   REP   6  LAST 1011   17,3005  11=626 0  ACROLL   CCS    RACFAIL   CHECK FOR REAL FAILURES
 0157   REP   1              17,3006  1 3012 0           TCF    RAFAIL    ON AC QUADS
 0158   REP   1              17,3007  1 3022 0           TCF    RXLNS
 0159   REP   1              17,3010  1 3014 0           TCF    RCFAIL
 0160   REP   2  LAST 1014   17,3011  1 3022 0           TCF    RXLNS

 0161   REP   7  LAST 1012   17,3012  3 4334 1  RAFAIL   CAF    NINE      QUAD FAILURE  WILL GET
 0162   REP   1              17,3013  1 3024 0           TCF    TABRCOM   1-JET OPERATION
 0163   REP   4  LAST 1012   17,3014  3 5656 1  RCFAIL   CAF    TWELVE
 0164   REP   2  LAST 1014   17,3015  1 3024 0           TCF    TABRCOM

 0165                       17,3016   00000 1  XLN1NDX  DEC    0
 0166                       17,3017   00001 0           DEC    1         INDECES FOR TRANSLATION
 0167                       17,3020   00002 0           DEC    2
 0168                       17,3021   00000 1           DEC    0

R0169   TABLE LOOK UP FOR AC-ROLL COMMANDS WITH AND WITHOUT Y-TRANSLATION AND ACQUAD FAILURES PRESENT
R0171   BITS 9,10,11 CONTAIN THE MAGNITUDE AND DIRECTION OF THE ROLL

 0172   REP   5  LAST 1011   17,3022  51=515 1  RXLNS    INDEX  YNDX      NO AC QUAD FAILURES
 0173   REP   3  LAST 1013   17,3023  3 2705 1           CA     XLNNDX    INCLUDE +,-,0, Y-TRANSLATION
 0174   REP   3  LAST 1014   17,3024  6 1517 0  TABRCOM  AD     RINDEX
 0175   REP 234  LAST 1013   17,3025  50 000 1           INDEX  A
 0176   REP   1              17,3026  3 3155 0           CA     RTABLE
 0177   REP   1              17,3027  7 3174 1           MASK   ACRJETS   = 3760 OCT
 0178   REP   3  LAST  987   17,3030  55=451 1           TS     RWORD1

R0179   CHECK FOR Z-TRANSLATIONS ON BD

 0180   REP   4  LAST 1011   17,3031  3 1516 1  BDZCHECK CA     ZNDX
 0181                       17,3032  0 0006 1           EXTEND
 0182   REP   1              17,3033  6 3065 1           BZMF   NOBDZ     NO Z-TRANSLATION
```

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P0183          TABLE LOOK UP FOR BD Z-TRANSLATION WITH AND WITHOUT REAL BD QUAD FAILURES.  Z-TRANSLATION WILL BE POSS-
R0185   IBLE AS LONG AS ROLL COMMANDS CAN BE SATISFIED WITH THE AC ROLL JETS.   CRITERION.. IF THE RESULTANT NET ROLL
R0187   COMMANDS = 0 (WITH Z-TRANSLATION) AND IF TAU = 0, THEN INCLUDE THE BD Z-TRANSLATION COMMANDS. IF THE RESULTANT
R0189   ROLL COMMAND = 0, AND IF TAU NZ, THEN IGNORE THE BD Z-TRANSLATION

0190   REF   6  LAST 1012   17,3034  11∝627 1          CCS    RBDFAIL
0191   REF  34  LAST 1011   17,3035  3 6214 0          CAF    THREE
0192                        17,3036  1 3040 1          TCF    +2
0193   REF  31  LAST  982   17,3037  3 6211 0          CAF    SIX
0194   REF   5  LAST 1014   17,3040  51∝516 1          INDEX  ZNDX
0195   REF   1              17,3041  6 3016 0          AD     XLN1NDX
0196   REF 235  LAST 1014   17,3042  50 000 1          INDEX  A
0197   REF   1              17,3043  3 3176 1          CA     YZTABLE
0198   REF   1              17,3044  7 3207 0          MASK   BDZJETS      = 3417 OCT
0199   REF   4  LAST 1014   17,3045  6 1451 0          AD     RWORD1       ADD TO ROLL COMMANDS
0200   REF  31  LAST 1010   17,3046  55∝502 0          TS     T5TEMP       IF POSSIBLE.  MUST CHECK TAU FIRST

0201                        17,3047  0 0006 1          EXTEND
0202   REF  46  LAST 1012   17,3050  7 4704 1          MP     BIT7         DETERMINE THE NET ROLL COMMAND WITH
0203   REF   1              17,3051  6 6061 0          AD     =-4          Z-TRANSLATION ADDED ON
0204   REF   2  LAST  106   17,3052  55∝522 1          TS     NRJETS       NET NO. OF +,- ROLL JETS ON
0205                        17,3053  0 0006 1          EXTEND
0206   REF   1              17,3054  1 3060 0          BZF    TAUCHECK

0207   REF  32  LAST 1015   17,3055  3 1502 1  ACRBDZ  CA     T5TEMP       Z-TRANSLATION ACCEPTED EVEN THO WE MAY
0208   REF   5  LAST 1015   17,3056  55∝451 1          TS     RWORD1       HAVE INTRODUCED AN UNDESIREABLE ROLL
0209   REF   1              17,3057  1 3321 0          TCF    ROLLTIME     BRANCH TO JET ON-TIME CALCULATIONS

0210   REF   7  LAST 1014   17,3060  11∝561 0  TAUCHECK CCS    TAU
0211   REF   2  LAST 1014   17,3061  1 3065 0          TCF    NOBDZ
0212   REF   1              17,3062  1 3055 0          TCF    ACRBDZ
0213   REF   3  LAST 1015   17,3063  1 3065 0          TCF    NOBDZ
0214   REF   2  LAST 1015   17,3064  1 3055 0          TCF    ACRBDZ

0215   REF   6  LAST 1015   17,3065  3 1451 0  NOBDZ   CA     RWORD1       Z-TRANSLATION NOT ACCEPTED
0216                        17,3066  0 0006 1          EXTEND
0217   REF  47  LAST 1015   17,3067  7 4704 1          MP     BIT7
0218   REF   1              17,3070  6 7715 0          AD     =-2
0219   REF   3  LAST 1015   17,3071  55∝522 1          TS     NRJETS
0220   REF   2  LAST 1015   17,3072  1 3321 0          TCF    ROLLTIME     BRANCH TO JET ON-TIME CALCULATION
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P0221 BD QUAD SELECTION FOR ROLL COMMANDS

0222	REF	7	LAST 1015	17,3073	11«627 1	BDROLL	CCS	RBDFAIL	
0223	REF	1		17,3074	1 3100 1		TCF	RBFAIL	
0224	REF	1		17,3075	1 3104 0		TCF	RZXLNS	
0225	REF	1		17,3076	1 3102 0		TCF	RDFAIL	
0226	REF	2	LAST 1016	17,3077	1 3104 0		TCF	RZXLNS	
0227	REF	8	LAST 1014	17,3100	3 4334 1	RBFAIL	CAF	NINE	
0228	REF	1		17,3101	1 3106 1		TCF	TABRZCMD	
0229	REF	5	LAST 1014	17,3102	3 5656 1	RDFAIL	CAF	TWELVE	
0230	REF	2	LAST 1016	17,3103	1 3106 1		TCF	TABRZCMD	
0231	REF	6	LAST 1015	17,3104	51«516 1	RZXLNS	INDEX	ZNDX	NO BD FAILURES
0232	REF	4	LAST 1014	17,3105	3 2705 1		CA	XLNNDX	+,-,0 Z-TRANSLATION PRESENT
0233	REF	4	LAST 1014	17,3106	6 1517 0	TABRZCMD	AD	RINDEX	
0234	REF	236	LAST 1015	17,3107	50 000 1		INDEX	A	
0235	REF	2	LAST 1014	17,3110	3 3155 0		CA	RTABLE	
0236	REF	1		17,3111	7 3175 0		MASK	BDRJETS	= 34017 OCT
0237	REF	7	LAST 1015	17,3112	55«451 1		TS	RWORD1	
0238	REF	6	LAST 1014	17,3113	3 1515 1	ACYCHECK	CA	YNDX	ANY Y-TRANSLATION
0239				17,3114	0 0006 1		EXTEND		
0240	REF	1		17,3115	1 3147 1		BZF	NOACY	NO Y-TRANSLATION
0241	REF	7	LAST 1014	17,3116	11«626 0		CCS	RACFAIL	
0242	REF	35	LAST 1015	17,3117	3 6214 0		CAF	THREE	
0243				17,3120	1 3122 1		TCF	+2	
0244	REF	32	LAST 1015	17,3121	3 6211 0		CAF	SIX	
0245	REF	7	LAST 1016	17,3122	51«515 1		INDEX	YNDX	
0246	REF	2	LAST 1015	17,3123	6 3016 0		AD	XLN1NDX	
0247	REF	237	LAST 1016	17,3124	50 000 1		INDEX	A	
0248	REF	2	LAST 1015	17,3125	3 3176 1		CA	YZTABLE	
0249	REF	1		17,3126	7 3210 0		MASK	ACYJETS	= 34360 OCT
0250	REF	8	LAST 1016	17,3127	6 1451 0		AD	RWORD1	
0251	REF	33	LAST 1015	17,3130	55«502 0		TS	T5TEMP	
0252				17,3131	0 0006 1		EXTEND		FOR EXPLANATION SEE CODING ON RTABLE
0253	REF	35	LAST 993	17,3132	7 4707 1		MP	BIT4	
0254	REF	2	LAST 1015	17,3133	6 6061 0		AD	=-4	
0255	REF	4	LAST 1015	17,3134	55«522 1		TS	NRJETS	NO. OF NET ROLL JETS
0256				17,3135	0 0006 1		EXTEND		
0257	REF	1		17,3136	1 3142 1		BZF	TAUCHCK	IF NRJETS = 0
0258	REF	34	LAST 1016	17,3137	3 1502 1	BDRACZ	CA	T5TEMP	Y-TRANSLATION ACCEPTED
0259	REF	9	LAST 1016	17,3140	55«451 1		TS	RWORD1	
0260	REF	3	LAST 1015	17,3141	1 3321 0		TCF	ROLLTIME	BRANCH TO JET ON-TIME CALCULATIONS
0261	REF	8	LAST 1015	17,3142	11«561 0	TAUCHCK	CCS	TAU	
0262	REF	2	LAST 1016	17,3143	1 3147 1		TCF	NOACY	
0263	REF	1		17,3144	1 3137 0		TCF	BDRACZ	
0264	REF	3	LAST 1016	17,3145	1 3147 1		TCF	NOACY	
0265	REF	2	LAST 1016	17,3146	1 3137 0		TCF	BDRACZ	

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0266   REF  10  LAST 1016   17,3147  3 1451 0  NOACY   CA     RWORD1      Y-TRANSLATION NOT ACCEPTED
0267                        17,3150  0 0006 1           EXTEND
0268   REF  36  LAST 1016   17,3151  7 4707 1           MP     BIT4
0269   REF   2  LAST 1015   17,3152  6 7715 0           AD     =-2
0270   REF   5  LAST 1016   17,3153  55"522 1           TS     NRJETS
0271   REF   4  LAST 1016   17,3154  1 3321 0           TCF    ROLLTIME
```

R0272 TABLE FOR ROLL, Y AND Z-TRANSLATION COMMANDS

R0273 EITHER AC OR BD ROLL MAY BE SELECTED. IF AC ROLL IS SELECTED, Y-TRANSLATIONS MAY BE SATISFIED SIMULTANEOUSLY
R0275 PROVIDED THAT THERE ARE NO AC QUAD FAILURES. IF THERE ARE AC FAILURES, Y-TRANSLATION COMMANDS WILL BE IGNORED,
R0277 IN WHICH CASE THE ASTRONAUT SHOULD SWITCH TO BD ROLL.
R0278 IF BDROLL IS SELECTED, Z-TRANSLATIONS MAY BE SATISFIED SIMULTANEOUSLY PROVIDED THAT THERE ARE NO BD QUAD
R0280 FAILURES. IF THERE ARE BD FAILURES, Z-TRANSLATION COMMANDS WILL BE IGNORED, IN WHICH CASE THE ASTRONAUT SHOULD
R0282 SWITCH TO AC ROLL.
R0283 NOTE THAT IF ONE QUAD FAILS (E.G. B FAILED), Z-TRANSLATION IS STILL POSSIBLE AND THAT THE UNDESIREABLE ROLL
R0285 INTRODUCED BY THIS TRANSLATION WILL BE COMPENSATED BY THE TWO AC ROLL JETS ACTUATED BY THE AUTOPILOT LOGIC.

R0287 WORD MAKE UP....RTABLE

R0288 TWO WORDS, CORRESPONDING TO AC OR BD ROLL SELECTION, HAVE BEEN COMBINED INTO ONE TABLE. THE WORD CORRESPOND-
R0290 ING TO AC ROLL HAS THE FOLLOWING INTERPRETATION..
R0291 BITS 9,10,11 ARE CODED TO GIVE THE NET ROLL TORQUE FOR THE WORD SELECTED. THE CODING IS..
R0293 BIT NO. 11 10 9 NO. OF ROLL JETS

R0294 0 0 0 -2
R0295 0 0 1 -1
R0296 0 1 0 0
R0297 0 1 1 +1
R0298 1 0 0 +2
R0299 THIS WORD MAY THEN BE ADDED TO THE WORD SELECTED FROM THE YZ-TRANSLATION TABLE, WHICH HAS THE SAME TYPE OF
R0301 CODING AS ABOVE, AND THE NET ROLL DETERMINED BY SHIFTING THE RESULTANT WORD RIGHT 8 PLACES AND SUBTRACTING FOUR.

R0303 THE WORD CORRESPONDING TO BD ROLL HAS A SIMILIAR INTERPRETATION, EXCEPT THAT BITS 12, 13, 14 ARE CODED
R0305 (AS ABOVE) TO GIVE THE NET ROLL TORQUE.

A0306							ROLL	TRANS	QUADFAIL	BIAS
0307	17,3155	11000 1	RTABLE	OCT	11000		0			0
0308	17,3156	22125 1		OCT	22125		+			0
0309	17,3157	00252 1		OCT	00252		-			0
0310	17,3160	11231 1		OCT	11231		0	+Y(+Z)		3
0311	17,3161	15421 1		OCT	15421		+	+Y(+Z)		3
0312	17,3162	04610 1		OCT	04610		-	+Y(+Z)		3
0313	17,3163	11146 1		OCT	11146		0	-Y(-Z)		6
0314	17,3164	15504 1		OCT	15504		+	-Y(-Z)		6
0315	17,3165	04442 1		OCT	04442		-	-Y(-Z)		6
0316	17,3166	11000 1		OCT	11000		0		A(B)	9
0317	17,3167	15504 1		OCT	15504		+		A(B)	9
0318	17,3170	04610 1		OCT	04610		-		A(B)	9
0319	17,3171	11000 1		OCT	11000		0		C(D)	12
0320	17,3172	15421 1		OCT	15421		+		C(D)	12
0321	17,3173	04442 1		OCT	04442		-		C(D)	12

```
R0322           RTABLE MASKS -

0323                    17,3174   03760 0  ACRJETS  OCT   03760
0324                    17,3175   34017 0  BORJETS  OCT   34017
```

R0325 Y, Z TRANSLATION TABLE

R0326 ONCE AC OR BD ROLL IS SELECTED THE QUAD PAIR WHICH IS NOT BEING USED TO SATISFY THE ROLL COMMANDS MAY BE
R0328 USED TO SATISFY THE REMAINING TRANSLATION COMMANDS. HOWEVER, WE MUST MAKE SURE THAT ROLL COMMANDS ARE SATISFIED
R0330 WHEN THEY OCCUR. THEREFORE, THE Y-Z TRANSLATIONS FROM THIS TABLE WILL BE IGNORED IF THE NET ROLL TORQUE OF THE
R0332 COMBINED WORD IS ZERO AND THE ROLL COMMANDS ARE NON-ZERO. THIS SITUATION WOULD OCCUR, FOR EXAMPLE, IF WE EN-
R0334 COUNTER SIMULTANEOUS +R +Y -Z COMMANDS AND A QUAD D FAILURE WHILE USING AC FOR ROLL.
R0336 TO FACILITATE THE LOGIC, THE Y-Z TRANSLATION TABLE HAS BEEN CODED IN A MANNER SIMILIAR TO THE ROLL TABLE
R0338 ABOVE.
R0339 BITS 9,10,11 ARE CODED TO GIVE THE NET ROLL TORQUE INCURRED BY Z-TRANSLATIONS. THE WORD SELECTED CAN THEN BE
R0341 ADDED TO THE AC-ROLL WORD AND THE RESULTANT ROLL TORQUE DETERMINED FROM THE COMBINED WORD. SIMILIARLY BITS
R0343 12,13,14 ARE CODED TO GIVE THE NET ROLL TORQUE INCURRED BY Y-TRANSLATIONS WHEN BD-ROLL IS SELECTED.

A0345

							TRANSLATION	QUADFAIL	BIAS
0346		17,3176	11000 1	YZTABLE	OCT	11000	0		0
0347		17,3177	11231 1		OCT	11231	+Z(+Y)		0
0348		17,3200	11146 1		OCT	11146	-Z(-Y)		0
0349		17,3201	11000 1		OCT	11000	0	B(A)	3
0350		17,3202	04610 1		OCT	04610	+Z(+Y)	B(A)	3
0351		17,3203	15504 1		OCT	15504	-Z(-Y)	B(A)	3
0352		17,3204	11000 1		OCT	11000	0	D(C)	6
0353		17,3205	15421 1		OCT	15421	+Z(+Y)	D(C)	6
0354		17,3206	04442 1		OCT	04442	-Z(-Y)	D(C)	6

R0355 YZ-TABLE MASKS-

0356	17,3207	03417 0	BDZJETS	OCT	03417	
0357	17,3210	34360 0	ACYJETS	OCT	34360	

R0358 ADDITIONAL CONSTANTS

0359	REF	4	LAST 914	7715	=-2	=	NEG2	
0360	REF	1		6061	=-4	=	NEG4	

P0361 CALCULATION OF JET ON-TIMES

R0362 THE ROTATION COMMANDS (TAU'S), WHICH WERE DETERMINED FROM THE JET SWITCHING LOGIC ON THE BASIS OF SINGLE JET
R0364 OPERATION, MUST NOW BE UPDATED BY THE ACTUAL NUMBER OF JETS TO BE USED IN SATISFYING THESE COMMANDS. TAU MUST
R0366 ALSO BE DECREMENTED ACCORDING TO THE EXPECTED TORQUE GENERATED BY THE NEW COMMANDS ACTING OVER THE NEXT T5 INT-
R0368 ERVAL.
R0369 IN ORDER TO MAINTAIN ACCURATE KNOWLEDGE OF VEHICLE ANGULAR RATES, WE MUST ALSO PROVIDE EXPECTED FIRING TIMES
R0371 (DPT'S, ALSO IN TERMS OF 1-JET OPERATION) FOR THE RATE FILTER.
R0372 NOTE THAT TRANSLATIONS CAN PRODUCE ROTATIONS EVEN THOUGH NO ROTATIONS WERE CALLED FOR. NEVERTHELESS, WE MUST
R0374 UPDATE DPT.
R0375 WHEN THE ROTATIONS HAVE FINISHED, WE MUST PROVIDE CHANNEL INFORMATION TO THE T6 PROGRAM TO CONTINUE ON WITH
R0377 THE TRANSLATIONS. THIS WILL BE DONE IN THE NEXT SECTION. HOWEVER, TO INSURE THAT JETS ARE NOT FIRED FOR LESS
R0379 THAN A MINIMUM IMPULSE (14MS), ALL JET CHANNEL COMMANDS WILL BE HELD FIXED FROM THE START OF THE T5 PROGRAM FOR
R0381 ATLEAST 14MS UNTIL THE INITIALIZATION OF NEW COMMANDS. MOREOVER, A 14MS ON-TIME WILL BE ADDED TO ANY ROTATIONAL
R0383 COMMANDS GENERATED BY THE MANUAL CONTROLS OR THE JET SWITCHING LOGIC, AND ALL TRANSLATION COMMANDS WILL BE
R0385 ACTIVE FOR ATLEAST ONE CYCLE OF THE T5 PROGRAM (.1SEC)

R0386 PITCH JET ON-TIME CALCULATION

```
0387  REP  6  LAST 1011   17,3211  11=562 0  PITCHTIM CCS    TAU1
0388  REP  1              17,3212  1 3221 1            TCF    PTAUPOS
0389                      17,3213  1 3215 0            TCF    +2
0390  REP  1              17,3214  1 3217 1            TCF    PTAUNEG
0391  REP  2  LAST  106   17,3215  55=550 1            TS     DPT1        NO PITCH ROTATION
0392  REP  1              17,3216  1 3417 1            TCF    PBYPASS     COMMANDS

0393  REP  3  LAST 1012   17,3217  4 1523 0  PTAUNEG   CS     NPJETS
0394  REP  4  LAST 1021   17,3220  55=523 0            TS     NPJETS
0395  REP  7  LAST 1021   17,3221  3 1562 1  PTAUPOS   CA     TAU1
0396                      17,3222  0 0006 1            EXTEND
0397  REP  5  LAST 1021   17,3223  5 1523 1            INDEX  NPJETS
0398  REP  1              17,3224  7 3400 1            MP     NJET
0399  REP  3  LAST  987   17,3225  55=461 1            TS     BLAST1
0400  REP  1              17,3226  6 3333 1            AD     =-.1SEC
0401                      17,3227  0 0006 1            EXTEND
0402  REP  1              17,3230  6 3241 0            BZMF   AD14MSP
0403  REP  6  LAST 1021   17,3231  51=523 1            INDEX  NPJETS
0404  REP  1              17,3232  3 3334 0            CA     DPTMAX      THE PITCH ON-TIME IS GREATER THAN .1 SEC
0405  REP  3  LAST 1021   17,3233  55=550 1            TS     DPT1
0406                      17,3234  4 0000 0            COM
0407  REP  8  LAST 1021   17,3235  27=562 0            ADS    TAU1        UPDATE TAU1
0408  REP  1              17,3236  3 3335 1            CAF    =+.1SEC     LIMIT THE LENGTH OF PITCH ROTATION
0409  REP  4  LAST 1021   17,3237  55=461 1            TS     BLAST1      COMMANDS TO 0.1 SEC SO THAT ONLY
0410  REP  1              17,3240  1 3404 0            TCF    ASMBLWP     X-TRANSLATIONS WILL CONTINUE ON SWITCH
A0411                                                                     OVER TO TVC
0412  REP  5  LAST 1021   17,3241  4 1461 1  AD14MSP   CS     BLAST1      SEE IF JET ON TIME LESS THAN
0413  REP  2  LAST 1010   17,3242  6 3340 0            AD     =14MS       MINIMUM IMPULSE TIME
0414                      17,3243  0 0006 1            EXTEND
0415  REP  1              17,3244  6 3247 0            BZMF   PBLASTOK    IF SO LIMIT MINIMUM ON TIME TO 14 MS
0416  REP  3  LAST 1021   17,3245  3 3340 0            CAF    =14MS
```

L JET SELECTION LOGIC


```
0417  REF  6  LAST 1021  17,3246  55=461 1          TS     BLAST1
0418  REF  7  LAST 1022  17,3247  3 1461 0  PBLASTOK CA     BLAST1
0419                     17,3250  0 0006 1          EXTEND
0420  REF  7  LAST 1021  17,3251  7 1523 0          MP     NPJETS
0421  REF  4  LAST 1021  17,3252  23=550 0          LXCH   DFT1
0422  REF  9  LAST 1021  17,3253  55=562 0          TS     TAU1
0423  REF  2  LAST 1021  17,3254  1 3404 0          TCF    ASMBLWP
```

THE PITCH COMMANDS WILL BE COMPLETED
WITHIN THE TS-CYCLE TIME
FOR USE IN UPDATING RATE FILTER
ZERO TAU1 (ACC CONTAINS ZERO)

L JET SELECTION LOGIC

P0424 YAW JET ON-TIME CALCULATION

```
0425  REF  6  LAST 1012   17,3255  11"563 1  YAWTIME  CCS    TAU2
0426  REF  1              17,3256  1 3265 1           TCF    YTAUPOS
0427                      17,3257  1 3261 0           TCF    +2
0428  REF  1              17,3260  1 3263 1           TCF    YTAUNEG
0429  REF  2  LAST  106   17,3261  55"551 0           TS     DFT2      NO YAW ROTATION COMMANDS
0430  REF  1              17,3262  1 3563 0           TCF    YBYPASS

0431  REF  2  LAST 1013   17,3263  4 1524 1  YTAUNEG  CS     NYJETS
0432  REF  3  LAST 1023   17,3264  55"524 1           TS     NYJETS
0433  REF  7  LAST 1023   17,3265  3 1563 0  YTAUPOS  CA     TAU2
0434                      17,3266  0 0006 1           EXTEND
0435  REF  4  LAST 1023   17,3267  5 1524 0           INDEX  NYJETS
0436  REF  2  LAST 1021   17,3270  7 3400 1           MP     NJET
0437  REF  3  LAST  987   17,3271  55"463 0           TS     BLAST2
0438  REF  2  LAST 1021   17,3272  6 3333 1           AD     =-.1SEC
0439                      17,3273  0 0006 1           EXTEND
0440  REF  1              17,3274  6 3305 1           BZMF   AD14MSY
0441  REF  5  LAST 1023   17,3275  51"524 0           INDEX  NYJETS
0442  REF  2  LAST 1021   17,3276  3 3334 0           CA     DFTMAX    YAW COMMANDS WILL LAST LONGER THAN .1SEC
0443  REF  3  LAST 1023   17,3277  55"551 0           TS     DFT2
0444                      17,3300  4 0000 0           COM
0445  REF  8  LAST 1023   17,3301  27"563 1           ADS    TAU2      DECREMENT TAU2
0446  REF  2  LAST 1021   17,3302  3 3335 1           CAF    =+.1SEC   LIMIT THE LENGTH OF YAW ROTATION COMMAND
0447  REF  4  LAST 1023   17,3303  55"463 0           TS     BLAST2    TO 0.1 SEC SO THAT ONLY X-TRANSLATION
0448  REF  1              17,3304  1 3550 0           TCF    ASMBLWY   WILL CONTINUE ON SWITCH OVER TO TVC

0449  REF  5  LAST 1023   17,3305  4 1463 0  AD14MSY  CS     BLAST2    SEE IF JET ON-TIME LESS THAN
0450  REF  4  LAST 1021   17,3306  6 3340 0           AD     =14MS     MINIMUM IMPULSE TIME
0451                      17,3307  0 0006 1           EXTEND
0452  REF  1              17,3310  6 3313 0           BZMF   YBLASTOK  IF SO, LIMIT MINIMUM ON-TIME TO 14 MS
0453  REF  5  LAST 1023   17,3311  3 3340 0           CAF    =14MS
0454  REF  6  LAST 1023   17,3312  55"463 0           TS     BLAST2
0455  REF  7  LAST 1023   17,3313  3 1463 1  YBLASTOK CA     BLAST2    YAW COMMANDS WILL BE COMPLETED WITHIN
0456                      17,3314  0 0006 1           EXTEND           THE T5CYCLE TIME
0457  REF  6  LAST 1023   17,3315  7 1524 1           MP     NYJETS
0458  REF  4  LAST 1023   17,3316  23"551 1           LXCH   DFT2
0459  REF  9  LAST 1023   17,3317  55"563 1           TS     TAU2      ZERO TAU2
0460  REF  2  LAST 1023   17,3320  1 3550 0           TCF    ASMBLWY
```

P0461 ROLL ON-TIME CALCULATION-

```
0462  REP  9  LAST 1016   17,3321  11∝561 0  ROLLTIME CCS    TAU
0463  REP  1              17,3322  1 3341 0           TCF    RBLAST
0464                      17,3323  1 3325 1           TCF    +2
0465  REP  2  LAST 1024   17,3324  1 3341 0           TCF    RBLAST
0466  REP  6  LAST 1017   17,3325  51∝522 0           INDEX  NRJETS
0467  REP  3  LAST 1023   17,3326  3 3334 0           CA     DPTMAX
0468  REP  3  LAST  977   17,3327  55∝547 1           TS     DPT
0469  REP  1              17,3330  1 3543 1           TCF    RBYPASS

0470                      17,3331   77037 0           DEC    -480
0471                      17,3332   77277 0           DEC    -320
0472                      17,3333   77537 0  =-.1SEC  DEC    -160
0473                      17,3334   00000 1  DPTMAX   DEC    0
0474                      17,3335   00240 1  =+.1SEC  DEC    160
0475                      17,3336   00500 1           DEC    320
0476                      17,3337   00740 1           DEC    480
0477                      17,3340   00027 1  =14MS    DEC    23

0478  REP  10 LAST 1024   17,3341  3 1561 1  RBLAST   CA     TAU
0479                      17,3342  0 0006 1           EXTEND
0480  REP  7  LAST 1024   17,3343  5 1522 0           INDEX  NRJETS
0481  REP  3  LAST 1023   17,3344  7 3400 1           MP     NJET
0482  REP  2  LAST  100   17,3345  55∝457 1           TS     BLAST
A0483
0484  REP  3  LAST 1023   17,3346  6 3333 1           AD     =-.1SEC
0485                      17,3347  0 0006 1           EXTEND
0486  REP  1              17,3350  6 3361 0           BZMF   AD14MSR
0487  REP  8  LAST 1024   17,3351  51∝522 0           INDEX  NRJETS
0488  REP  4  LAST 1024   17,3352  3 3334 0           CA     DPTMAX
0489  REP  4  LAST 1024   17,3353  55∝547 1           TS     DPT
0490                      17,3354  4 0000 0           COM
0491  REP  11 LAST 1024   17,3355  27∝561 0           ADS    TAU
0492  REP  3  LAST 1023   17,3356  3 3335 1           CAF    =+.1SEC
0493  REP  3  LAST 1024   17,3357  55∝457 1           TS     BLAST
0494  REP  1              17,3360  1 3424 1           TCF    ASMBLWR

0495  REP  4  LAST 1024   17,3361  4 1457 1  AD14MSR  CS     BLAST
0496  REP  6  LAST 1023   17,3362  6 3340 0           AD     =14MS
0497                      17,3363  0 0006 1           EXTEND
0498  REP  1              17,3364  6 3367 0           BZMF   RBLASTOK
0499  REP  7  LAST 1024   17,3365  3 3340 0           CAF    =14MS
0500  REP  5  LAST 1024   17,3366  55∝457 1           TS     BLAST
0501  REP  6  LAST 1024   17,3367  3 1457 0  RBLASTOK CA     BLAST
0502                      17,3370  0 0006 1           EXTEND
0503  REP  9  LAST 1024   17,3371  7 1522 1           MP     NRJETS
0504  REP  5  LAST 1024   17,3372  23∝547 0           LXCH   DPT
0505  REP  12 LAST 1024   17,3373  55∝561 0           TS     TAU
0506  REP  2  LAST 1024   17,3374  1 3424 1           TCF    ASMBLWR
```

UPDATE DPT EVEN THO NO ROLL COMMANDS ARE PRESENT

= -.3SEC
= -.2SEC
= -.1SEC
0
= +.1SEC
= +.2SEC
= +.3SEC
=14MS

BLAST IS AN INTERMEDIATE VARIABLE USED IN DETERMINING THE JET ON-TIMES

THE ROLL ROTATION WILL LAST LONGER THAN THE T5 CYCLE TIME

LIMIT THE LENGTH OF ROLL ROTATION COMMANDS TO 0.1 SEC SO THAT ONLY Y-Z TRANSLATION COMMANDS CONTINUE

SEE IF THE JET ON-TIME LESS THAN MINIMUM IMPULSE TIME

IF SO, LIMIT MINIMUM ON-TIME TO 14 MS

ZERO TAU

```
0507          17,3375   65252 1          DEC    -.333333     = -1/3
0508          17,3376   57777 1          DEC    -.500000     = -1/2
0509          17,3377   40000 0          DEC    -.999999     = -1 (NEGMAX)
0510          17,3400   00000 1  NJET    DEC    0
0511          17,3401   37777 1          DEC    .999999      = +1 (POSMAX)
0512          17,3402   20000 0          DEC    .500000      = +1/2
0513          17,3403   12525 0          DEC    .333333      = +1/3
```

P0514 WHEN THE ROTATION COMMANDS ARE COMPLETED, IT IS NECESSARY TO REPLACE THESE COMMANDS BY NEW COMMANDS WHICH
R0516 CONTINUE ON WITH THE TRANSLATIONS IF ANY ARE PRESENT.
R0517 IN THIS SECTION THESE NEW COMMANDS ARE GENERATED AND STORED FOR REPLACEMENT OF THE CHANNEL COMMANDS WHEN THE
R0519 CORRESPONDING ROTATIONS ARE COMPLETED.

R0520 GENERATION OF THE SECOND PITCH(X-TRANS) WORD...$PWORD_2$

```
0521  REF   8  LAST 1016   17,3404  11∝626 0  ASMBLWP  CCS    RACFAIL
0522  REF   1              17,3405  1 3413 0           TCF    FPX2        IF FAILURE ON AC IGNORE X-TRANSLATION
0523                       17,3406  1 3410 0           TCF    +2
0524  REF   2  LAST 1026   17,3407  1 3413 0           TCF    FPX2
0525  REF   7  LAST 1012   17,3410  51∝513 1           INDEX  XNDX1
0526  REF   5  LAST 1016   17,3411  3 2705 1           CA     XLNNDX
0527  REF 238  LAST 1016   17,3412  50 000 1           INDEX  A
0528  REF   3  LAST 1013   17,3413  3 2741 1  FPX2     CA     PYTABLE
0529  REF   2  LAST 1012   17,3414  7 2760 0           MASK   PJETS
0530  REF   2  LAST  100   17,3415  55∝454 1           TS     PWORD2
0531  REF   1              17,3416  1 3255 1           TCF    YAWTIME

0532  REF   3  LAST 1012   17,3417  3 1453 1  PBYPASS  CA     PWORD1      THE T6 PROGRAM WILL LOAD PWORD2
0533  REF   3  LAST 1026   17,3420  55∝454 1           TS     PWORD2      UPON ENTRY
0534  REF 185  LAST 1007   17,3421  3 4714 1           CAF    ZERO
0535  REF   8  LAST 1022   17,3422  55∝461 1           TS     BLAST1      THERE IS NO PWORD2
0536  REF   2  LAST 1026   17,3423  1 3255 1           TCF    YAWTIME
```

P0537 GENERATION OF THE SECOND ROLL (Y,Z) WORD (RWORD2)

```
0538  REP   6  LAST 1016   17,3424  11"515 0  ASMBLWR  CCS   YNDX      CHECK FOR Y-TRANS
0539  REP   1               17,3425  1 3435 1          TCF   ACBD2Y
0540  REP 186  LAST 1028   17,3426  3 4714 1  NO2Y     CAF   ZERO
0541  REP   2  LAST  100   17,3427  55"452 1          TS    RWORD2
0542  REP   7  LAST 1016   17,3430  11"516 0          CCS   ZNDX      CHECK FOR Z-TRANS
0543  REP   1               17,3431  1 3500 0          TCF   ACBD2Z
0544  REP 187  LAST 1027   17,3432  3 4714 1  NO2Z     CAF   ZERO
0545  REP   3  LAST 1027   17,3433  27"452 1          ADS   RWORD2
0546  REP   1               17,3434  1 3211 1          TCF   PITCHTIM    RWORD2 ASSEMBLED

0547  REP   4  LAST 1014   17,3435  11"630 1  ACBD2Y   CCS   ACORBD
0548  REP   1               17,3436  1 3453 1          TCF   AC2Y       CAN DO Y-TRANS
0549  REP   2  LAST 1027   17,3437  1 3453 1          TCF   AC2Y
0550                        17,3440  1 3441 1          TCF   +1         USING AC FOR ROLL
0551  REP   9  LAST 1026   17,3441  11"626 0          CCS   RACFAIL
0552  REP   1               17,3442  1 3426 0          TCF   NO2Y       USING AC AND AC HAS FAILED
0553                        17,3443  1 3445 0          TCF   +2
0554  REP   2  LAST 1027   17,3444  1 3426 0          TCF   NO2Y       DITTO

0555  REP   9  LAST 1027   17,3445  51"515 1          INDEX YNDX       NO FAILURES, CAN DO Y
0556  REP   6  LAST 1026   17,3446  3 2705 1          CA    XLNNDX
0557  REP 239  LAST 1026   17,3447  50 000 1          INDEX A
0558  REP   3  LAST 1016   17,3450  3 3155 0          CA    RTABLE
0559  REP   2  LAST 1014   17,3451  7 3174 1          MASK  ACRJETS
0560  REP   3  LAST 1027   17,3452  1 3427 1          TCF   NO2Y +1

0561  REP  10  LAST 1027   17,3453  11"626 0  AC2Y     CCS   RACFAIL
0562  REP  36  LAST 1016   17,3454  3 6214 0          CAF   THREE
0563                        17,3455  1 3457 0          TCF   +2
0564  REP  33  LAST 1016   17,3456  3 6211 0          CAF   SIX
0565  REP  10  LAST 1027   17,3457  51"515 1          INDEX YNDX
0566  REP   3  LAST 1016   17,3460  6 3016 0          AD    XLN1NDX
0567  REP 240  LAST 1027   17,3461  50 000 1          INDEX A
0568  REP   3  LAST 1016   17,3462  3 3176 1          CA    YZTABLE
0569  REP   2  LAST 1016   17,3463  7 3210 0          MASK  ACYJETS
0570  REP   4  LAST 1027   17,3464  55"452 1          TS    RWORD2
0571                        17,3465  0 0006 1          EXTEND
0572  REP  37  LAST 1017   17,3466  7 4707 1          MP    BIT4
0573  REP   3  LAST 1017   17,3467  6 7715 0          AD    =-2
0574  REP  10  LAST 1024   17,3470  55"522 1          TS    NRJETS
0575  REP   7  LAST 1024   17,3471  4 1457 1          CS    BLAST
0576  REP   4  LAST 1024   17,3472  6 3335 1          AD    =+.1SEC
0577                        17,3473  0 0006 1          EXTEND
0578  REP  11  LAST 1027   17,3474  7 1522 1          MP    NRJETS
0579  REP 129  LAST  996   17,3475  3 0001 0          CA    L
0580  REP   6  LAST 1024   17,3476  27"547 1          ADS   DPT
0581  REP   4  LAST 1027   17,3477  1 3430 1          TCF   NO2Y +2
```

L JET SELECTION LOGIC


```
0582  REF   5  LAST 1027   17,3500  11'630 1  ACBD2Z   CCS   ACORBD
0583  REF   1               17,3501  1 3531 1           TCF   BDF2Z      USING BD-ROLL
0584  REF   2  LAST 1028   17,3502  1 3531 1           TCF   BDF2Z      MUST CHECK FOR BD FAILURES
0585                        17,3503  1 3504 1           TCF   +1
0586  REF   8  LAST 1016   17,3504  11'627 1           CCS   RBDFAIL
0587  REF  37  LAST 1027   17,3505  3 6214 0           CAF   THREE      USING AC FOR ROLL, CAN DO Z-TRANS
0588                        17,3506  1 3510 1           TCF   +2
0589  REF  34  LAST 1027   17,3507  3 6211 0           CAF   SIX
0590  REF   8  LAST 1027   17,3510  51'516 1           INDEX ZNDX
0591  REF   4  LAST 1027   17,3511  6 3016 0           AD    XLN1NDX
0592  REF 241  LAST 1027   17,3512  50 000 1           INDEX A
0593  REF   4  LAST 1027   17,3513  3 3176 1           CA    YZTABLE
0594  REF   2  LAST 1015   17,3514  7 3207 0           MASK  BDZJETS
0595  REF   5  LAST 1027   17,3515  27'452 1           ADS   RWORD2
0596                        17,3516  0 0006 1           EXTEND
0597  REF  48  LAST 1015   17,3517  7 4704 1           MP    BIT7
0598  REF   4  LAST 1027   17,3520  6 7715 0           AD    =-2
0599  REF  12  LAST 1027   17,3521  55'522 1           TS    NRJETS
0600  REF   8  LAST 1027   17,3522  4 1457 1           CS    BLAST
0601  REF   5  LAST 1027   17,3523  6 3335 1           AD    =+.1SEC
0602                        17,3524  0 0006 1           EXTEND
0603  REF  13  LAST 1028   17,3525  7 1522 1           MP    NRJETS
0604  REF 130  LAST 1027   17,3526  3 0001 0           CA    L
0605  REF   7  LAST 1027   17,3527  27'547 1           ADS   DFT
0606  REF   2  LAST 1027   17,3530  1 3211 1           TCF   PITCHTIM

0607  REF   9  LAST 1028   17,3531  11'627 1  BDF2Z    CCS   RBDFAIL
0608  REF   1               17,3532  1 3432 0           TCF   NO2Z       USING BD-ROLL AND BD HAS FAILED
0609                        17,3533  1 3535 0           TCF   +2
0610  REF   2  LAST 1028   17,3534  1 3432 0           TCF   NO2Z       DITTO
0611  REF   9  LAST 1028   17,3535  51'516 1           INDEX ZNDX
0612  REF   7  LAST 1027   17,3536  3 2705 1           CA    XLNNDX
0613  REF 242  LAST 1028   17,3537  50 000 1           INDEX A
0614  REF   4  LAST 1027   17,3540  3 3155 0           CA    RTABLE
0615  REF   2  LAST 1016   17,3541  7 3175 0           MASK  BDRJETS
0616  REF   3  LAST 1028   17,3542  1 3433 1           TCF   NO2Z +1

0617  REF  11  LAST 1017   17,3543  3 1451 0  RBYPASS  CA    RWORD1
0618  REF   6  LAST 1028   17,3544  55'452 1           TS    RWORD2
0619  REF 188  LAST 1027   17,3545  3 4714 1           CAF   ZERO
0620  REF   9  LAST 1028   17,3546  55'457 1           TS    BLAST
0621  REF   3  LAST 1028   17,3547  1 3211 1           TCF   PITCHTIM
```

P0622 GENERATION OF THE SECOND YAW (X-TRANS) WORD...YWORD2

```
0623  REF  10  LAST 1028   17,3550  11=627 1  ASMBLWY  CCS    RBDFAIL
0624  REF   1              17,3551  1 3557 1           TCF    FYX2     IF FAILURE ON BD IGNORE X-TRANSLATION
0625                       17,3552  1 3554 1           TCF    +2
0626  REF   2  LAST 1029   17,3553  1 3557 1           TCF    FYX2
0627  REF   6  LAST 1013   17,3554  51=514 0           INDEX  XNDX2
0628  REF   8  LAST 1028   17,3555  3 2705 1           CA     XLNNDX
0629  REF 243  LAST 1028   17,3556  50 000 1           INDEX  A
0630  REF   4  LAST 1026   17,3557  3 2741 1  FYX2     CA     PYTABLE
0631  REF   2  LAST 1013   17,3560  7 2761 1           MASK   YJETS
0632  REF   2  LAST  100   17,3561  55=456 0           TS     YWORD2
0633  REF   1              17,3562  1 3567 1           TCF    T6SETUP

0634  REF   3  LAST 1013   17,3563  3 1455 1  YBYPASS  CA     YWORD1
0635  REF   3  LAST 1029   17,3564  55=456 0           TS     YWORD2
0636  REF 189  LAST 1028   17,3565  3 4714 1           CAF    ZERO
0637  REF   8  LAST 1023   17,3566  55=463 0           TS     BLAST2
```

P0638 SORT THE JET ON-TIMES

R0639 AT THIS POINT ALL THE CHANNEL COMMANDS AND JET ON-TIMES HAVE BEEN DETERMINED. IN SUMMARY THESE ARE-

R0641 RWORD$_1$
R0642 RWORD$_2$ BLAST

R0643 PWORD$_1$
R0644 PWORD$_2$ BLAST$_1$

R0645 YWORD$_1$
R0646 YWORD$_2$ BLAST$_2$

R0647 IN THIS SECTION THE JET ON-TIMES ARE SORTED AND THE SEQUENCE OF T6 INTERRUPTS IS DETERMINED. TO FACILITATE
R0649 THE SORTING PROCESS AND THE T6 PROGRAM, THE VARIABLES BLAST, BLAST$_1$, BLAST$_2$, ARE RESERVED AS DOUBLE PRECISION
R0651 WORDS. THE LOWER PART OF THESE WORDS CONTAIN A BRANCH INDEX ASSOCIATED WITH THE ROTATION AXIS OF THE HIGHER
R0653 ORDER WORD.

```
0654  REP 190  LAST 1029   17,3567  3 4714 1  T6SETUP  CAF    ZERO          BRANCH INDEX FOR ROLL
0655  REP  10  LAST 1028   17,3570  55∝460 0           TS     BLAST +1
0656  REP  14  LAST 1001   17,3571  3 4710 0           CAF    FOUR          BRANCH INDEX FOR PITCH
0657  REP   9  LAST 1026   17,3572  55∝462 1           TS     BLAST1 +1
0658  REP   8  LAST  987   17,3573  3 4717 1           CAF    ELEVEN        BRANCH INDEX FOR YAW
0659  REP   9  LAST 1029   17,3574  55∝464 1           TS     BLAST2 +1

0660  REP  11  LAST 1030   17,3575  4 1457 1           CS     BLAST
0661  REP  10  LAST 1030   17,3576  6 1461 0           AD     BLAST1
0662                       17,3577  0 0006 1           EXTEND
0663  REP   1              17,3600  6 3624 1           BZMF   DXCHT12       T1 GR T2
0664  REP  11  LAST 1030   17,3601  4 1461 1  CHECKT23 CS     BLAST1
0665  REP  10  LAST 1030   17,3602  6 1463 1           AD     BLAST2
0666                       17,3603  0 0006 1           EXTEND
0667  REP   1              17,3604  6 3630 1           BZMF   DXCHT23
0668  REP  12  LAST 1030   17,3605  4 1461 1  CALCDT6  CS     BLAST1
0669  REP  11  LAST 1030   17,3606  27∝463 0           ADS    BLAST2
0670  REP  12  LAST 1030   17,3607  4 1457 1           CS     BLAST
0671  REP  13  LAST 1030   17,3610  27∝461 1           ADS    BLAST1        END OF SORTING PROCEDURE
0672                       17,3611  0 0006 1           EXTEND                RESET T5LOC TO BEGIN PHASE1
0673  REP   1              17,3612  3 3623 0           DCA    RCS2CADR
0674  REP  21  LAST 1007   17,3613  53∝313 0           DXCH   T5LOC
0675  REP  69  LAST  987   17,3614  4 4712 0  ENDJETS  CS     BIT1          RESET BIT1 FOR INITIALIZATION OF
0676  REP  47  LAST 1004   17,3615  7 1501 0           MASK   RCSFLAGS       T6 PROGRAM
0677  REP  48  LAST 1030   17,3616  55∝501 0           TS     RCSFLAGS
0678  REP 191  LAST 1030   17,3617  4 4714 0           CS     ZERO          RESET T5PHASE FOR PHASE1
0679  REP  10  LAST  993   17,3620  55∝465 0           TS     T5PHASE
0680  REP  40  LAST 1007   17,3621  1 5222 1           TCF    RESUME        RESUME INTERRUPTED PROGRAM
0681  REP  38  LAST 1010   E6,1510                    EBANK= KMPAC
0682  REP   5  LAST  973   17,3622   02106 1 RCS2CADR 2CADR  RCSATT
0682                       17,3623   42066 1
```

```
0683  REF  13  LAST 1030   17,3624  53=460 0  DXCHT12  DXCH   BLAST
0684  REF  14  LAST 1030   17,3625  53=462 1            DXCH   BLAST1
0685  REF  14  LAST 1031   17,3626  53=460 0            DXCH   BLAST
0686  REF   1              17,3627  1 3601 1            TCF    CHECKT23

0687  REF  15  LAST 1031   17,3630  53=462 1  DXCHT23  DXCH   BLAST1
0688  REF  12  LAST 1030   17,3631  53=464 1            DXCH   BLAST2
0689  REF  16  LAST 1031   17,3632  53=462 1            DXCH   BLAST1
0690  REF  15  LAST 1031   17,3633  4 1457 1            CS     BLAST
0691  REF  17  LAST 1031   17,3634  6 1461 0            AD     BLAST1
0692                       17,3635  0 0006 1            EXTEND
0693                       17,3636  6 3640 0            BZMF   +2
0694  REF   1              17,3637  1 3605 0            TCF    CALCDT6
0695  REF  16  LAST 1031   17,3640  53=460 0            DXCH   BLAST
0696  REF  18  LAST 1031   17,3641  53=462 1            DXCH   BLAST1
0697  REF  17  LAST 1031   17,3642  53=460 0            DXCH   BLAST
0698  REF   2  LAST 1031   17,3643  1 3605 0            TCF    CALCDT6
```

P0699 T6 PROGRAM AND CHANNEL SETUP

```
0700                          21,3751                          BANK   21
0701  REF   1                 17,2000                          SETLOC DAPS5
0702                          17,3644                          BANK

0703  REF  19  LAST 1010      17,3644  22 016 0  T6START  LXCH   BANKRUPT
0704                          17,3645  0 0006 1            EXTEND
0705  REF  15  LAST 1010      17,3646  22 012 1            QXCH   QRUPT
0706  REF   5  LAST 1010      17,3647  10 031 1            CCS    TIME6          CHECK TO SEE IF TIME6 WAS RESET
0707  REF  41  LAST 1030      17,3650  1 5222 1            TCF    RESUME         AFTER T6RUPT OCCURED(IN T5RUPT)
0708                          17,3651  1 3653 0            TCF    +2             IF SO WAIT FOR NEXT T6RUPT BEFORE
0709  REF  42  LAST 1032      17,3652  1 5222 1            TCF    RESUME         TAKING ACTION

0710  REF  49  LAST 1030      17,3653  4 1501 0            CS     RCSFLAGS
0711  REF  70  LAST 1030      17,3654  7 4712 0            MASK   BIT1           IF BIT1 IS 0 RESET TO 1
0712                          17,3655  0 0006 1            EXTEND                AND INITIALIZE CHANNEL
0713  REF   1                 17,3656  1 3667 1            BZF    T6RUPTOR
0714  REF  50  LAST 1032      17,3657  27∝501 0            ADS    RCSFLAGS
0715  REF  12  LAST 1028      17,3660  3 1451 0            CA     RWORD1
0716                          17,3661  0 0006 1            EXTEND                INITIALIZE CHANNELS 5,6 WITH WORD1
0717  REF   7  LAST  959      17,3662  01 006 0            WRITE  CHAN6
0718  REF   4  LAST 1026      17,3663  3 1453 1            CA     PWORD1
0719  REF   4  LAST 1029      17,3664  6 1455 1            AD     YWORD1
0720                          17,3665  0 0006 1            EXTEND
0721  REF   3  LAST  652      17,3666  01 005 0            WRITE  CHAN5

0722  REF  18  LAST 1031      17,3667  11∝457 1  T6RUPTOR CCS    BLAST
0723  REF   1                 17,3670  1 3747 1            TCF    ZBLAST         ZERO BLAST1
0724  REF   1                 17,3671  1 3706 1            TCF    REPLACE        REPLACE WORD1
0725                          17,3672  1 3674 0            TCF    +2
0726  REF   2  LAST 1032      17,3673  1 3706 1            TCF    REPLACE
0727  REF  19  LAST 1031      17,3674  11∝461 1  T6L1     CCS    BLAST1
0728  REF   1                 17,3675  1 3752 0            TCF    ZBLAST1
0729  REF   1                 17,3676  1 3713 0            TCF    REPLACE1
0730                          17,3677  1 3701 0            TCF    +2
0731  REF   2  LAST 1032      17,3700  1 3713 0            TCF    REPLACE1
0732  REF  13  LAST 1031      17,3701  11∝463 0  T6L2     CCS    BLAST2
0733  REF   1                 17,3702  1 3755 1            TCF    ZBLAST2
0734  REF   1                 17,3703  1 3720 0            TCF    REPLACE2
0735  REF  43  LAST 1032      17,3704  1 5222 1            TCF    RESUME
0736  REF   2  LAST 1032      17,3705  1 3720 0            TCF    REPLACE2

0737  REF  19  LAST 1032      17,3706  51∝460 1  REPLACE  INDEX  BLAST +1
0738  REF   1                 17,3707  0 3725 1            TC     REPLACER
0739  REF 110  LAST 1014      17,3710  4 4712 0            CS     ONE
0740  REF  20  LAST 1032      17,3711  55∝457 1            TS     BLAST
0741  REF   1                 17,3712  1 3674 0            TCF    T6L1

0742  REF  20  LAST 1032      17,3713  51∝462 0  REPLACE1 INDEX  BLAST1 +1
```

```
0743  REP   2  LAST 1032   17,3714  0 3725 1          TC      REPLACER
0744  REP 111  LAST 1032   17,3715  4 4712 0          CS      ONE
0745  REP  21  LAST 1032   17,3716  55=461 1          TS      BLAST1
0746  REP   1              17,3717  1 3701 0          TCF     T6L2

0747  REP  14  LAST 1032   17,3720  51=464 0 REPLACE2 INDEX   BLAST2 +1
0748  REP   3  LAST 1033   17,3721  0 3725 1          TC      REPLACER
0749  REP 112  LAST 1033   17,3722  4 4712 0          CS      ONE
0750  REP  15  LAST 1033   17,3723  55=463 0          TS      BLAST2
0751  REP  44  LAST 1032   17,3724  1 5222 1          TCF     RESUME

0752  REP   7  LAST 1028   17,3725  3 1452 0 REPLACER CA      RWORD2
0753                        17,3726  0 0006 1          EXTEND                INITIALIZE CHANNELS 5,6 WITH WORD 2
0754  REP   8  LAST 1032   17,3727  01 006 0          WRITE   CHAN6
0755  REP 200  LAST  992   17,3730  0 0002 0          TC      Q

0756  REP   3  LAST 1029   17,3731  3 2761 0 REPLACEP CA      YJETS
0757                        17,3732  0 0006 1          EXTEND
0758  REP   4  LAST 1032   17,3733  02 005 0          RAND    CHAN5
0759  REP   4  LAST 1026   17,3734  6 1454 0          AD      PWORD2
0760                        17,3735  0 0006 1          EXTEND
0761  REP   5  LAST 1033   17,3736  01 005 0          WRITE   CHAN5
0762  REP 201  LAST 1033   17,3737  0 0002 0          TC      Q

0763  REP   3  LAST 1028   17,3740  3 2760 1 REPLACEY CA      PJETS
0764                        17,3741  0 0006 1          EXTEND
0765  REP   6  LAST 1033   17,3742  02 005 0          RAND    CHAN5
0766  REP   4  LAST 1029   17,3743  6 1456 1          AD      YWORD2
0767                        17,3744  0 0006 1          EXTEND
0768  REP   7  LAST 1033   17,3745  01 005 0          WRITE   CHAN5
0769  REP 202  LAST 1033   17,3746  0 0002 0          TC      Q

0770  REP 192  LAST 1030   17,3747  3 4714 1 ZBLAST   CAF     ZERO
0771  REP  21  LAST 1032   17,3750  57=457 0          XCH     BLAST
0772  REP   1              17,3751  1 3757 0          TCF     ENABT6
0773  REP 193  LAST 1033   17,3752  3 4714 1 ZBLAST1  CAF     ZERO
0774  REP  22  LAST 1033   17,3753  57=461 0          XCH     BLAST1
0775  REP   2  LAST 1033   17,3754  1 3757 0          TCF     ENABT6
0776  REP 194  LAST 1033   17,3755  3 4714 1 ZBLAST2  CAF     ZERO
0777  REP  16  LAST 1033   17,3756  57=463 1          XCH     BLAST2
0778  REP   6  LAST 1032   17,3757  54 031 1 ENABT6   TS      TIME6
0779  REP  10  LAST 1010   17,3760  3 4674 0          CAF     NEGMAX
0780                        17,3761  0 0006 1          EXTEND
0781  REP  11  LAST 1010   17,3762  05 013 0          WOR     CHAN13        ENABLE T6RUPT
0782  REP  45  LAST 1033   17,3763  1 5222 1          TCF     RESUME

R0783                END OF T6 INTERRUPT

0784                        17,3764          ENDSLECT EQUALS
```

```
L       CM ENTRY DIGITAL AUTOPILOT                                                    USER=S PAGE NO.   1      E0 S3

R0001   SUBROUTINE TO READ GYMBAL ANGLES AND FORM DIFFERENCES.   GIMBAL ANGLES ARE SAVED IN 2S COMPLEMENT, BUT THE
R0003   DIFFERENCES ARE IN 1S COMP.     ENTER AND READ ANGLES EACH .1 SEC.

R0004           CM/DSTBY = 1  FOR DAP OPERATION
R0005           CM/DSTBY = 0 TO TERMINATE DAP OPERATION.

 0006                          15,2454                        BANK   15

 0007   REF   1                15,2000                        SETLOC ETRYDAP
 0008                          15,2454                        BANK

 0009   REF   1                                               COUNT  15/DAPEN

 0010   REF  29  LAST  842     E6,1661                        EBANK= AOG

 0011   REF   6  LAST  960     15,2454  3 4377 0  READGYMB CA     TEN          KEEP RESTART DT GOING RELATIVE TO
 0012   REF   5  LAST  779     15,2455  27∝725 1             ADS    CM/GYMDT     PIPTIME. (GROUP 6)

A0013                                                                  IF A RESTART OCCURS, SKIP PRESENT CYCLE. THE
A0014                                                                  PHASCHNG PROTECTION IS IN CM/DAPIC.

 0015   REF  42  LAST  993     15,2456  3 4705 1             CA     BIT6         CHECK FOR FINE ALIGN MODE OF CDU.
 0016   REF  28  LAST  986     15,2457  7 1321 1             MASK   IMODES33     ( PROTECT AOG/PIP ETC AS WELL AS
 0017                          15,2460  0 0006 1             EXTEND               GIMBAL DIFFERENCES)
 0018   REF   1                15,2461  1 2467 1             BZF    READGYM1     OK

 0019   REF  71  LAST 1032     15,2462  4 4712 0             CS     BIT1         NOT IN FINE ALIGN, SO IDLE.
 0020   REF  10  LAST  840     15,2463  7 0102 0             MASK   CM/FLAGS     SET GYMDIFSW =0
 0021   REF  11  LAST 1034     15,2464  54 102 0             TS     CM/FLAGS
 0022   REF   1                15,2465  0 6000 1             TC     FLUSHJET     QUENCH JETS, SINCE MAY BE A WHILE.
 0023   REF   1                15,2466  0 2534 1             TC     CM/GYMIC +2

 0024   REF  27  LAST 1008     15,2467  3 0032 0  READGYM1 CA     CDUX
 0025   REF  30  LAST 1034     15,2470  57∝661 1             XCH    AOG
 0026                          15,2471  0 0006 1             EXTEND
 0027   REF  31  LAST 1034     15,2472  21∝661 0             MSU    AOG          -DELAOG=AOG(N-1) - AOG(N)
 0028   REF   2  LAST  109     15,2473  55∝675 0             TS     -DELAOG

 0029   REF  15  LAST  998     15,2474  3 0033 1             CA     CDUY
 0030   REF   2  LAST  109     15,2475  57∝662 1             XCH    AIG
 0031                          15,2476  0 0006 1             EXTEND
 0032   REF   3  LAST 1034     15,2477  21∝662 0             MSU    AIG
 0033   REF   2  LAST  109     15,2500  55∝676 0             TS     -DELAIG

 0034   REF  21  LAST 1008     15,2501  3 0034 0             CA     CDUZ
 0035   REF   3  LAST  778     15,2502  57∝663 0             XCH    AMG
 0036                          15,2503  0 0006 1             EXTEND
 0037   REF   4  LAST 1034     15,2504  21∝663 1             MSU    AMG
 0038   REF   2  LAST  109     15,2505  55∝677 1             TS     -DELAMG
```

L CM ENTRY DIGITAL AUTOPILOT

```
0039  REF  12  LAST 1034   15,2506  4 0102 0  DOBRATE#  CS     CM/FLAGS     CM/DSTBY=103D BIT2  GYMDIPSW=104D BIT1
0040  REF  38  LAST 1028   15,2507  7 6214 1            MASK   THREE
0041  REF 244  LAST 1029   15,2510  50 000 1            INDEX  A
0042                       15,2511  0 2512 0            TC     +1
0043  REF   1              15,2512  0 2521 0            TC     DOBRATE      OK, GO ON
0044  REF   2  LAST 1034   15,2513  0 2532 1            TC     CM/GYMIC     DONT CALC BODYRATE ON FIRST PASS.
0045                       15,2514  12 515 0            NOOP
0046  REF   2  LAST 1034   15,2515  0 6000 1            TC     FLUSHJET     TURN OFF ALL JETS

0047  REF  88  LAST  844   15,2516  0 5301 0            TC     PHASCHNG
0048                       15,2517   00006 1            OCT    00006        DEACTIVATE DAP GROUP 6.

0049  REF  50  LAST  958   15,2520  0 5213 1            TC     TASKOVER

0050  REF 113  LAST 1033   15,2521  3 4712 1  DOBRATE   CA     ONE          DO BODYRATE
0051  REF   2  LAST  110   15,2522  55#720 1  DOBRATE1  TS     JETEM        SKIP BODYRATE.

0052  REF   7  LAST 1034   15,2523  3 4377 0            CA     TEN          KEEP CDU READ GOING.
0053  REF  46  LAST  946   15,2524  0 5140 1            TC     WAITLIST
0054  REF  32  LAST 1034   E6,1661                      EBANK= ACG
0055  REF   2  LAST  213   15,2525   02454 0           2CADR  READGYMB
0055                       15,2526   32066 0

A0056                                                        DOES NOT PROTECT TEMK, SQ IN SPSIN/COS

0057  REF   3  LAST 1035   15,2527  11#720 1            CCS    JETEM
0058  REF   1              15,2530  0 2556 0            TC     BODYRATE
0059  REF  51  LAST 1035   15,2531  0 5213 1            TC     TASKOVER     SKIP CALC ON INITIAL PASS. (PASSES)

0060  REF  13  LAST 1035   15,2532  26 102 0  CM/GYMIC  ADS    CM/FLAGS     GYMDIPSW' C(A)=1, KNOW BIT IS 0
0061  REF 195  LAST 1033   15,2533  3 4714 1            CAF    ZERO
0062  REF   2  LAST  109   15,2534  55#711 0            TS     JETAG
0063  REF   2  LAST  109   15,2535  55#706 0            TS     OLDELP
0064  REF   2  LAST  109   15,2536  55#707 1            TS     OLDELQ
0065  REF   2  LAST  109   15,2537  55#710 1            TS     OLDELR
0066  REF   4  LAST  840   15,2540  55#723 1            TS     GAMDOT       NO GYM DIF, PROB NO GAM DIF.
0067  REF   1              15,2541  0 2522 0            TC     DOBRATE1
```

```
P0068   COME HERE TO CORRECT FOR OVERFLOW IN ANGULAR CALCULATIONS

0069   REP 131  LAST 1028   15,2542  54 001 1  ANGOVCOR TS      L        THIS COSTS 2 MCT TO USE.
0070   REP 203  LAST 1033   15,2543  0 0002 0            TC      Q        NO OVFL
0071   REP 245  LAST 1035   15,2544  50 000 1            INDEX   A
0072   REP   4  LAST  956   15,2545  3 4673 1            CAF     LIMITS
0073   REP 132  LAST 1036   15,2546  26 001 1            ADS     L
0074   REP 204  LAST 1036   15,2547  0 0002 0            TC      Q

0075                          6000                       BLOCK   3

0076   REP   1                                          COUNT   03/DAPEN

0077                          6000  3 0007 0  FLUSHJET CA      7        COME HERE TO TURN OFF ALL JETS.
0078                          6001  0 0006 1           EXTEND
0079   REP   1                6002  01 006 0           WRITE   ROLLJETS ZERO CHANNEL 6
0080                          6003  0 0006 1           EXTEND
0081   REP   1                6004  01 005 0           WRITE   PYJETS   ZERO CHANNEL 5
0082   REP 205  LAST 1036     6005  0 0002 0           TC      Q

0083                        15,2550                    BANK    15

0084   REP   2 LAST 1034 TO 1036'   60    60*         COUNT   15/DAPEN

0085   REP   2  LAST 1034   15,2000                    SETLOC  ETRYDAP
0086                        15,2550                    BANK

0087                        15,2550  4 0000 0  RATEAVG  COM
0088   REP   4  LAST 1035   15,2551  6 1720 0           AD      JETEM    SUBROUTINE TO ESTIMATE RATES IN PRESENCE
0096                        15,2552  0 0006 1           EXTEND           OF CONSTANT ACCELERATION.
0097   REP   3  LAST  436   15,2553  7 4675 0           MP      HALF
0098   REP   5  LAST 1036   15,2554  6 1720 0           AD      JETEM    DELV (EST) = DELV +(DELV-OLDELV)/2
0099   REP 206  LAST 1036   15,2555  0 0002 0           TC      Q
```

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P0101 THESE ARE CALLED FOR THE VARIOUS INITIALIZATIONS NEEDED.

```
0102                          20,3565                        BANK   20
0103   REF   1                20,2000                        SETLOC DAPS1
0104                          20,3565                        BANK

0105   REF   1                                               COUNT  20/DAPEN

0106   REF  33  LAST 1035     E6,1661                        EBANK= AOG

0107   REF   3  LAST  841     20,3565  3 4752 0  CM/DAPON   CA     EBAOG
0108   REF  40  LAST  841     20,3566  54 003 0             TS     EBANK

0109   REF  52  LAST  783     20,3567  0 5447 0             TC     DOWNFLAG      RESET DAPBIT1.  T5 RESTART IDENTIFIER.
01095  REF   2  LAST  690     20,3570   00132 1             ADRES  DAPBIT1       BIT 15  FLAG 6          CM FLAGS.
0110   REF  53  LAST 1037     20,3571  0 5447 0             TC     DOWNFLAG      RESET DAPBIT2
01105  REF   2  LAST  690     20,3572   00133 0             ADRES  DAPBIT2       BIT 14  FLAG 6
0111                          20,3573  0 0006 1             EXTEND
0112   REF   1                20,3574  3 3712 0             DCA    T5IDLER1      DISABLE RCS CALCULATION
0113   REF  22  LAST 1030     20,3575  53∝313 0             DXCH   T5LOC
0114                          20,3576  0 0006 1             EXTEND
0115   REF   2  LAST 1037     20,3577  3 3712 0             DCA    T5IDLER1      DISABLE RCS JET CALLS
0116   REF   4  LAST  987     20,3600  53∝311 1             DXCH   T6LOC

0117   REF   3  LAST 1035     20,3601  0 6000 1             TC     FLUSHJET      JETS DEPARTED  ON SM. ZERO JET BITS.

0118   REF   5  LAST  983     20,3602  4 7707 1             CS     13,14,15
0119   REF  71  LAST 1010     20,3603  7 1466 0             MASK   DAPDATR1      SET  CONFIG  BITS =0 FOR ENTRY
0120   REF  72  LAST 1037     20,3604  55∝466 0             TS     DAPDATR1
0121                          20,3605  0 3611 1             TC     +4

0122   REF   8  LAST  904     20,3606  3 4731 0  NOTYET     CA     .5SEC
0123   REF 245  LAST  891     20,3607  0 4555 0             TC     BANKCALL
0124   REF  13  LAST  888     20,3610   01732 0             CADR   DELAYJOB      (DELAYJOB DOES INHINT)
0125   REF  30  LAST 1006     20,3611  3 4700 1  +4         CA     BIT11         GAMDIFSW = 94D  BIT11,  INITLY=0
0126   REF  14  LAST 1035     20,3612  7 0102 0             MASK   CM/FLAGS      IF ZERO, WAIT UNTIL CM/POSE UPDATE.
0127                          20,3613  0 0006 1             EXTEND
0128   REF   1                20,3614  1 3606 0             BZF    NOTYET

0129   REF 114  LAST 1035     20,3615  4 4712 0             CS     ONE           ACTIVATE CM/DAP
0130   REF  51  LAST 1032     20,3616  55∝501 0             TS     RCSFLAGS      USE BIT3 TO INITIALIZE NEEDLER ON
A0131                                                                            NEXT PASS.
0132   REF   3  LAST  749     20,3617  55∝727 0             TS     P63FLAG       SO WAKEP62 WILL NOT BE INITIATED UNTIL
A0133                                                                            HEADSUP IS SET IN P62.
A0134                                                                  FLAG TO PREVENT MULTIPLE CALLS TO WAKEP62.

0135                          20,3620  3 0007 0             CA     7
0136   REF   3  LAST 1035     20,3621  55∝711 0             TS     JETAG
01361  REF   3  LAST  173     20,3622  55∝713 1             TS     PAXERR1       KEEP NEEDLES ZERO UNTIL DAP UPDATE
A01362                                                                            IN CASE CMDAPMOD IS NOT +1.
```

```
0137                          20,3623  0 0004 0    INHINT
0138                          20,3624  0 0006 1    EXTEND
0139  REP  4  LAST  841       20,3625  3 1666 0    DCA    ALFA/180      DO ATTITUDE HOLD UNTIL KEYBOARD
0140  REP  3  LAST  747       20,3626  53=604 0    DXCH   ALFACOM       ESTABLISHES HEADSUP.
0141  REP  5  LAST  841       20,3627  3 1664 1    CA     ROLL/180
0142  REP  2  LAST  110       20,3630  55=717 0    TS     ROLLHOLD      FOR ATTITUDE HOLD IN MODE +1.
0143                          20,3631  0 0006 1    EXTEND
0144  REP  4  LAST 1036       20,3632  7 4675 0    MP     HALF
0145  REP 12  LAST  827       20,3633  55=715 1    TS     ROLLC         NOT INTERESTED IN LO WORD.

0146  REP 15  LAST 1037       20,3634  4 0102 0    CS     CM/FLAGS
0147  REP 28  LAST  932       20,3635  7 4677 1    MASK   BIT12         CMDAPARM =93D BIT12  INITLY=0
0148  REP 16  LAST 1038       20,3636  26 102 0    ADS    CM/FLAGS      SET BIT TO 1.

0149  REP 16  LAST  777       20,3637  4 0076 1    CS     FLAGWRD2      SET  NODOFLAG  TO PREVENT FURTHER
0150  REP 72  LAST 1034       20,3640  7 4712 0    MASK   BIT1          V 37 ENTRIES.
0151  REP 17  LAST 1038       20,3641  26 076 1    ADS    FLAGWRD2

0152                          20,3642  0 0003 1    RELINT

0153  REP 58  LAST  969       20,3643  0 4574 0    TC     POSTJUMP
0154  REP  1                  20,3644   54342 0    CADR   P62.1
```

```
P0155   INITIALIZE CM/DAP.   WAITLIST CALL FOR READGYMB.  SET SWITCH CM/DSTBY =1
R0156   SO READACCS WILL ENTER A WTLST CALL FOR  SETJTAG  .
R0157    CMDAPARM  = 0    , SO ONLY BODY RATE AND ATTITUDE CALCULATIONS ARE DONE.
R0158   SET AVEGEXIT TO CONTINUE AT CM/POSE
R0159

 0160   REP   4  LAST 1037   20,3645  3 4752 0  CM/DAPIC CA     EBACG
 0161   REP  41  LAST 1037   20,3646  54 003 0           TS     EBANK

 0162                        20,3647  0 0004 0           INHINT
 0163   REP  15  LAST  803   20,3650  4 1205 0  CM/DAP2C CS     PIPTIME +1
A0164                                                           PRIO OF P62 L PRIO AVG,'PIPTM=PIPTM1
 0165   REP   6  LAST 1036   20,3651  55x720 1           TS     JETEM

 0166   REP   1              20,3652  3 4675 1           CA     POS1/2
 0167   REP   2  LAST 1039   20,3653  6 4675 1           AD     POS1/2
 0168   REP  14  LAST  724   20,3654  6 0025 0           AD     TIME1          OVFL GUARANTEED
 0169   REP   7  LAST 1039   20,3655  27x720 1           ADS    JETEM          C(A) = DELTA TIME SINCE PIPUP

 0170   REP  25  LAST  989   20,3656  4 4715 1           CS     FIVE
 0171   REP   8  LAST 1039   20,3657  6 1720 0           AD     JETEM
 0172   REP 246  LAST 1036   20,3660  10 000 0           CCS    A
 0173   REP   1              20,3661  6 3710 1           AD     -CDUT+1
 0174                        20,3662  1 3660 0           TCF    -2
 0175                        20,3663  13 664 1           NOOP
 0176   REP 115  LAST 1037   20,3664  6 4712 1           AD     ONE            SEND NO ZERO TO WTLST
 0177   REP   6  LAST 1034   20,3665  55x725 1           TS     CM/GYMDT       FOR RESTART
 0178   REP  47  LAST 1035   20,3666  0 5140 1           TC     WAITLIST
 0179   REP  34  LAST 1037   E6,1661                     EBANK= ACG
 0180   REP   3  LAST 1035   20,3667   02454 0           2CADR  READGYMB
 0180                        20,3670   32066 0

 0181   REP   1              20,3671  4 3707 0           CS     CM/SWIC1       GAMDIPSW, GYMDIPSW, CM/DSTBY
 0182   REP  17  LAST 1038   20,3672  7 0102 0           MASK   CM/FLAGS       DAPARM, .05GSW, LATSW, ENTRYDSP
 0183   REP   1              20,3673  6 4377 0           AD     CM/SWIC2       SET CM/DSTBY, LATSW
A01831                                                          DISABLE ENTRY DISPLAY, SINCE DES. GIMB.
A01832                                                          CALC. (P62.3) GOES TO ENDEXIT.
 0184   REP  18  LAST 1039   20,3674  54 102 0           TS     CM/FLAGS

 0185                        20,3675  3 0007 0           CA     7
 0186   REP   5  LAST  841   20,3676  55x666 1           TS     BETA/180       NECESSARY' NO OVFL CORRECTION
 0188   REP 116  LAST 1039   20,3677  3 4712 1           CA     ONE            INITIALIZE THE TM OF BODY RATES VIA
 0189   REP   1              20,3700  54 305 0           TS     SW/NDX           UPBUFF.

 0190   REP  29  LAST  829   20,3701  0 5261 1           TC     2PHSCHNG       DOES INHINT/RELINT
 0191                        20,3702   40116 0           OCT    40116          SAVE TBASE6
 0192                        20,3703   05024 1           OCT    05024
 0193                        20,3704   13000 0           OCT    13000

 0194   REP  59  LAST 1038   20,3705  0 4574 0           TC     POSTJUMP
```

```
0195   REF   1                20,3706   54326 1          CADR   P62.2

0196                         20,3707   16017 0  CM/SWIC1  OCT    16017
01961  REF   8  LAST 1035       4377            CM/SWIC2  =      TEN          00012 ' CM/DSTBY, LATSW
0197                         20,3710   77766 0  -CDUT+1   OCT    77766
0198   REF  23  LAST 1037       1312                      EBANK= T5LOC
0199   REF   6  LAST  690    20,3711   03143 1  T5IDLER1 2CADR  T5IDLOC
0199                         20,3712   12062 0
```

L CM ENTRY DIGITAL AUTOPILOT USER=S PAGE NO. 8 E6 S3

P0200 THIS SECTION CALCULATES THE ANGULAR BODY RATES EACH .1 SEC. THE ANGULAR RATES ARE THOSE ALONG THE BODY AXES
R0202 XB, YB, ZB, AND ARE NORMALLY DESIGNATED P, Q, R. REQUIREMENT' TEMPORARY ERASE. JETEM, JETEM +1

R0204 SINCE RESTARTS ZERO THE JET OUTPUT CHANNELS, NO ATTEMPT IS MADE TO RESTART THE ENTRY DAPS. THAT IS,
R0206 THE 0.1 SEC DAPS WILL MISS A CYCLE, AND WILL PICK UP AT THE NEXT 0.1 SEC UPDATE. MOST OF THE TIME THE 2 SEC
R0208 ROLL SYSTEM WILL MISS ONLY 0.1 SEC OF CONTROL. HOWEVER IF THE RESTART OCCURS AFTER THE SECTION TIMETST HAS
R0210 STARTED, THEN THE ROLL SYSTEM WILL MISS ONE CYCLE.
R0211 THIS IS NECESSARY UNDER THE GROUNDRULE THAT NO JET COMMANDS SHALL BE LESS THAN 14 MS.

```
0213  REP  35  LAST 1039   E6,1661                    EBANK= AOG
0214                       15,2556                    BANK  15
0215  REP   3  LAST 1036   15,2000                    SETLOC ETRYDAP
02151                      15,2556                    BANK

0216  REP   3 LAST 1036 TO 1037'    6    66*         COUNT 15/DAPEN

0218  REP   5  LAST 1034   15,2556  3 1663 0  BODYRATE CA    AMG          THESE ARE 2S COMPL NOS, BUT USE ANYWAY.
0219  REP   3  LAST  970   15,2557  0 4767 0          TC    SPCOS
0220  REP   2  LAST  110   15,2560  55*511 1          TS    COSM

0221  REP  36  LAST 1041   15,2561  3 1661 1          CA    AOG          C(AOG) = AOG/180
0222  REP   3  LAST  970   15,2562  0 4770 0          TC    SPSIN        SINO
0223  REP   2  LAST  110   15,2563  55*512 1          TS    SINO         SINO = SIN(AOG)

0224                       15,2564  0 0006 1          EXTEND
0225  REP   3  LAST 1041   15,2565  7 1511 1          MP    COSM
0226  REP   2  LAST  110   15,2566  55*514 1          TS    SINOCOSM     SO CM

0227  REP  37  LAST 1041   15,2567  3 1661 1          CA    AOG
0228  REP   4  LAST 1041   15,2570  0 4767 0          TC    SPCOS        COSO
0229  REP   2  LAST  110   15,2571  55*513 0          TS    COSO

0230                       15,2572  0 0006 1          EXTEND
0231  REP   4  LAST 1041   15,2573  7 1511 1          MP    COSM
0232  REP   1             15,2574  55*515 0          TS    COSOCOSM     CO CM

R0233 PITCHDOT'   Q TCDU/180 = IDOT TCDU/180 COSO COSM + MDOT TCDU/180 SINO

0234  REP   3  LAST 1034   15,2575  4 1677 1          CS    -DELAMG
0235                       15,2576  0 0006 1          EXTEND
0236  REP   3  LAST 1041   15,2577  7 1512 1          MP    SINO
0237  REP   9  LAST 1039   15,2600  53*721 0          DXCH  JETEM        2 LOCS
0238  REP   3  LAST 1034   15,2601  4 1676 0          CS    -DELAIG
0239                       15,2602  0 0006 1          EXTEND
0240  REP   2  LAST 1041   15,2603  7 1515 0          MP    COSOCOSM
0241  REP  10  LAST 1041   15,2604  21*721 0          DAS   JETEM
0242  REP  11  LAST 1041   15,2605  3 1720 0          CA    JETEM
0243  REP   3  LAST 1035   15,2606  57*707 0          XCH   OLDELQ
0244  REP   1             15,2607  0 2550 0          TC    RATEAVG
0245  REP   2  LAST  109   15,2610  55*702 1          TS    QREL         PITCHDOT = Q TCDU/180
```

```
P0246   YAWDOT'   R TCDU/180 = -IDOT TCDU/180 COSM SINO + MDOT TCDU/180 COSO

 0247   REP   4  LAST 1041   15,2611  4 1677 1        CS     -DELAMG
 0248                        15,2612  0 0006 1        EXTEND
 0249   REP   3  LAST 1041   15,2613  7 1513 0        MP     COSO
 0250   REP  12  LAST 1041   15,2614  53«721 0        DXCH   JETEM
 0251   REP   4  LAST 1041   15,2615  3 1676 1        CA     -DELAIG
 0252                        15,2616  0 0006 1        EXTEND
 0253   REP   3  LAST 1041   15,2617  7 1514 1        MP     SINOCOSM
 0254   REP  13  LAST 1042   15,2620  21«721 0        DAS    JETEM
 0255   REP  14  LAST 1042   15,2621  3 1720 0        CA     JETEM
 0256   REP   3  LAST 1035   15,2622  57«710 0        XCH    OLDELR
 0257   REP   2  LAST 1041   15,2623  0 2550 0        TC     RATEAVG
 0258   REP   2  LAST  109   15,2624  55«703 0        TS     RREL          YAWDOT = R TCDU/180

R0259    ROLLDOT'   P TCDU/180 = ODOT TCDU/180 + IDOT TCDU/180 SINM

 0260   REP   6  LAST 1041   15,2625  3 1663 0        CA     AMG
 0261   REP   4  LAST 1041   15,2626  0 4770 0        TC     SPSIN
 0262   REP   2  LAST  110   15,2627  55«510 0        TS     SINM

 0263                        15,2630  0 0006 1        EXTEND
 0264   REP   5  LAST 1042   15,2631  7 1676 0        MP     -DELAIG
 0265   REP  15  LAST 1042   15,2632  55«720 1        TS     JETEM
 0266   REP 196  LAST 1035   15,2633  3 4714 1        CA     ZERO
 0267                        15,2634  20 001 1        DDOUBL                ROUND L INTO A
 0268   REP   3  LAST 1034   15,2635  6 1675 1        AD     -DELAOG
 0269   REP  16  LAST 1042   15,2636  6 1720 0        AD     JETEM
 0270   REP 247  LAST 1039   15,2637  4 0000 0        CS     A
 0271   REP  17  LAST 1042   15,2640  55«720 1        TS     JETEM
 0272   REP   3  LAST 1035   15,2641  57«706 1        XCH    OLDELP
 0273   REP   3  LAST 1042   15,2642  0 2550 0        TC     RATEAVG
 0274   REP   2  LAST  109   15,2643  55«701 1        TS     PREL          ROLLDOT = P TCDU/180

A0275                                                      IF GAMDOT  ± 0.5 DEG/SEC, THEN GAMDOT =0

 0276   REP   5  LAST 1035   15,2644  11«723 1        CCS    GAMDOT
 0277                        15,2645  0 2647 0        TC     +2
 0278   REP   1              15,2646  0 2671 0        TC     NOGAMDUT
 0279   REP   6  LAST 1038   15,2647  4 1664 0        CS     ROLL/180
 0280   REP   5  LAST 1042   15,2650  0 4770 0        TC     SPSIN
 0281                        15,2651  0 0006 1        EXTEND
 0282   REP   6  LAST 1042   15,2652  7 1723 1        MP     GAMDOT
 0283   REP  18  LAST 1042   15,2653  55«721 0        TS     JETEM  +1      -SR GAMDOT
 0284                        15,2654  0 0006 1        EXTEND
 0285   REP   1              15,2655  7 3217 1        MP     SINTRIM        SIN(-20)   (FOR NOMINAL L/D = .3)
 0287   REP   3  LAST 1042   15,2656  27«701 1        ADS    PREL           PREL TCDU/180=(P-SALP SR GAMDOT)TCDU/180

 0288   REP   7  LAST 1042   15,2657  3 1664 1        CA     ROLL/180
 0289   REP   5  LAST 1041   15,2660  0 4767 0        TC     SPCOS
```

```
0290                          15,2661  4 0000 0          COM
0291                          15,2662  0 0006 1          EXTEND
0292  REF   7  LAST 1042      15,2663  7 1723 1          MP      GAMDOT
0293  REF   3  LAST 1041      15,2664  27#702 1          ADS     QREL        QREL TCDU/180=(Q-CR GAMDOT) TCDU/180

0294  REF  19  LAST 1042      15,2665  4 1721 0          CS      JETEM +1    B( ) = -SR GAMDOT
0295                          15,2666  0 0006 1          EXTEND
0296  REF   1                 15,2667  7 3220 0          MP      COSTRIM     COS(-20)   (FOR NOMINAL L/D = .3)
0297  REF   3  LAST 1042      15,2670  27#703 0          ADS     RREL        RREL TCDU/180=(R+CALP SR GAMDOT)TCDU/180

0298  REF  29  LAST 1038      15,2671  3 4677 0  NOGAMDUT CA      BIT12       CMDAPARM = 93D  BIT 12
0299  REF  19  LAST 1039      15,2672  7 0102 0          MASK    CM/FLAGS
0300                          15,2673  0 0006 1          EXTEND
0301  REF  52  LAST 1035      15,2674  1 5213 0  STBYDUMP BZF     TASKOVER    DAP NOT ARMED.

0302  REF  27  LAST 1006      15,2675  3 4672 0          CA      POSMAX      PICK UP AT ATTRATES IN 10 MS OR SO.
0303  REF  25  LAST 1010      15,2676  54 030 0          TS      TIME5

0304                          15,2677  0 0006 1          EXTEND
0305  REF   1                 15,2700  3 2704 0          DCA     ATDOTCAD
0306  REF  24  LAST 1040      15,2701  53#313 0          DXCH    T5LOC
A0307                                                                DOES NOT PROTECT TEMK, SQ IN SPSIN/COS

0308  REF  53  LAST 1043      15,2702  0 5213 1          TC      TASKOVER

0309  REF  38  LAST 1041      E6,1661                    EBANK=  ACC
0310  REF   1                 15,2703   02705 1 ATDOTCAD 2CADR  ATTRATES
0310  REF   1                 15,2704   32066 0
```

P0311 CALCULATE BODY ATTITUDE RATES AND INTEGRATE TO OBTAIN ATTITUDE ANGLES.

R0312 CB PHIDOT TCDU/180 = (CA PREL + SA RREL) TCDU/180
R0313 BETADOT TCDU/180 = (-SA PREL + CA RREL) TCDU/180
R0314 ALPADOT TCDU = (QREL + SB PHIDOT) TCDU/180

0315	REP	20	LAST	1032	15,2705	22 016 0	ATTRATES	LXCH	BANKRUPT	CONTINUE HERE VIA T5
0316					15,2706	0 0006 1		EXTEND		TASK MAY BE SKIPPED AT RESTART.
0317	REP	16	LAST	1032	15,2707	22 012 1		QXCH	QRUPT	
0318	REP	11	LAST	356	15,2710	3 0021 1		CA	SR	
0319					15,2711	6 0000 1		DOUBLE		
0320	REP	2	LAST	111	15,2712	55∝623 0		TS	CM/SAVE	
A0321									DOES NOT PROTECT TEMK, SQ IN SPSIN/COS	
0322	REP	4	LAST	1043	15,2713	3 1702 0		CA	QREL	
0323	REP	5	LAST	1038	15,2714	6 1665 0		AD	ALPA/180	
0324	REP	1			15,2715	0 2542 0		TC	ANGOVCOR	
0325	REP	6	LAST	1044	15,2716	55∝665 1		TS	ALPA/180	
0326	REP	6	LAST	1042	15,2717	0 4767 0		TC	SPCOS	
0327	REP	2	LAST	110	15,2720	55∝506 1		TS	CALPA	CALPA
0328	REP	2	LAST	109	15,2721	55∝705 0		TS	PHIDOT	
0329					15,2722	0 0006 1		EXTEND		
0330	REP	4	LAST	1042	15,2723	7 1701 1		MP	PREL	
0331	REP	3	LAST	1044	15,2724	57∝705 1		XCH	PHIDOT	CA PREL
0332					15,2725	0 0006 1		EXTEND		
0333	REP	4	LAST	1043	15,2726	7 1703 0		MP	RREL	CA RREL
0334	REP	2	LAST	109	15,2727	55∝704 1		TS	BETADOT	
0335	REP	7	LAST	1044	15,2730	3 1665 0		CA	ALPA/180	
0336	REP	6	LAST	1042	15,2731	0 4770 0		TC	SPSIN	
0337	REP	2	LAST	110	15,2732	55∝507 0		TS	SALPA	SIN(ALPA)
0338					15,2733	0 0006 1		EXTEND		
0339	REP	5	LAST	1044	15,2734	7 1703 0		MP	RREL	SA RREL
0340	REP	4	LAST	1044	15,2735	27∝705 0		ADS	PHIDOT	CB PHIDOT, SAVED.
0341	REP	3	LAST	1044	15,2736	4 1507 0		CS	SALPA	
0342					15,2737	0 0006 1		EXTEND		
0343	REP	5	LAST	1044	15,2740	7 1701 1		MP	PREL	
0344	REP	3	LAST	1044	15,2741	27∝704 1		ADS	BETADOT	SAVE BETADOT TCDU/180
0345	REP	6	LAST	1039	15,2742	27∝666 1		ADS	BETA/180	BETA DONE.
0346	REP	7	LAST	1044	15,2743	0 4770 0		TC	SPSIN	
0347					15,2744	0 0006 1		EXTEND		
0348	REP	5	LAST	1044	15,2745	7 1705 0		MP	PHIDOT	NEGLECT CB IN CB PHIDOT
0349	REP	8	LAST	1044	15,2746	6 1665 0		AD	ALPA/180	
0350	REP	2	LAST	1044	15,2747	0 2542 0		TC	ANGOVCOR	
0351	REP	9	LAST	1044	15,2750	55∝665 1		TS	ALPA/180	ALPA DONE.

```
0352                          15,2751  4 0000 0          COM
0353  REF   4  LAST 1038      15,2752  6 1603 0          AD    ALFACOM
0354  REF   3  LAST 1044      15,2753  0 2542 0          TC    ANGOVCOR      JUST IN CASE ...
0355  REF   7  LAST  994      15,2754  55α477 0          TS    AK1
0356  REF   2  LAST  111      15,2755  55α572 1          TS    QAXERR        FOR PITCH FDAI   AND EDIT.

0357  REF   6  LAST 1044      15,2756  3 1705 1          CA    PHIDOT        PHIDOT TCDU/180, NEGLECTING CB
0358  REF   8  LAST 1042      15,2757  6 1664 1          AD    ROLL/180
0359  REF   4  LAST 1045      15,2760  0 2542 0          TC    ANGOVCOR
0360  REF   3  LAST  173      15,2761  55α714 0          TS    ROLLTM        ROLL/180 FOR TM.
0361  REF   9  LAST 1045      15,2762  55α664 0          TS    ROLL/180      ROLL DONE.

R0362      START YAW AUTOPILOT HERE .  RATE DAMPING WITH ENFORCED COORDINATED ROLL MANEUVER.

0364  REF  31  LAST  982      15,2763  3 4710 0          CA    BIT3          .05GSW =102D BIT3        SW=0, LESS .05G
0365  REF  20  LAST 1043      15,2764  7 0102 0          MASK  CM/FLAGS      SWITCH =1, GREATER THAN .05 G
0366                          15,2765  0 0006 1          EXTEND
0367  REF   1                 15,2766  1 3054 1          BZF   EXDAP         IF G LESS THAN .05
0368  REF 117  LAST 1039      15,2767  4 4712 0          CS    ONE           IF G GEQ  THAN .05
0369  REF   5  LAST  748      15,2770  55α700 0          TS    CMDAPMOD      SAVE -1 FOR USE IN CM/RCS

0370  REF   8  LAST 1045      15,2771  55α477 0          TS    AK1           TO ZERO PITCH AND YAW FDAI NEEDLES
0371  REF   8  LAST  994      15,2772  55α500 1          TS    AK2           IN ATM.  (MODE =-1)

03713 REF   6  LAST 1044      15,2773  4 1701 1          CS    PREL          YAW ERROR = RREL - PREL TAN(ALFA)
0372                          15,2774  0 0006 1          EXTEND
0373  REF   2  LAST 1042      15,2775  7 3217 1          MP    SINTRIM       LET SIN(-20) BE APPROX FOR TAN(-20)
0374  REF   6  LAST 1044      15,2776  6 1703 1          AD    RREL
0375  REF   1                 15,2777  0 3044 1          TC    2D/SDZ        GO TEST DZ. GET TAG' +0 IF IN DZ
0376  REF 248  LAST 1042      15,3000  50 000 1          INDEX A             +/- 1 IF NOT
0377  REF   1                 15,3001  3 3222 0          CAF   YJETCODE

0378  REF  20  LAST 1043      15,3002  55α720 1          TS    JETEM

R0379      START PITCH AUTOPILOT HERE.  RATE DAMPING ONLY.

0380  REF   5  LAST 1044      15,3003  3 1702 0          CA    QREL
0381  REF   2  LAST 1045      15,3004  0 3044 1          TC    2D/SDZ
0382  REF 249  LAST 1045      15,3005  50 000 1  EXDAPIN INDEX A             COME HERE FROM EX ATM DAP
0383  REF   1                 15,3006  3 3225 1          CAF   P/RJCODE
0384  REF  21  LAST 1045      15,3007  27α720 1          ADS   JETEM         COMBINE ALL NEW BITS.

0385                          15,3010  0 0006 1          EXTEND              DOES NOT REQUIRE SAVING OLD CODES.
0386  REF   2  LAST 1036      15,3011  01 005 0          WRITE PYJETS        SET PYCHAN TO DESIRED BIT CONFIG.

0387  REF   4  LAST 1037      15,3012  11α711 0          CCS   JETAG
0388  REF   1                 15,3013  0 3236 0          TC    CM/RCS
0389  REF   1                 15,3014  0 3716 1          TC    CM/FDAI
0390  REF   1                 15,3015  0 3723 1          TC    CM/FDAIR -1   (JETAG=-1 EQUIVALENT TO CMDAPMOD=+1)
```

P0391 DEAD ZONE LOGIC USED BY ENTRY DIGITAL AUTOPILOTS.

```
0392  REP 250  LAST 1045   15,3016  10 000 0  3DDZ     CCS   A          YAWLIM=1.0-3/180=16384-273=16111
0393  REP   1              15,3017  6 3215 1           AD    YAWLIM
0394  REP   1              15,3020  1 3050 0           TCF   DZCOM
0395  REP   2  LAST 1046   15,3021  6 3215 1           AD    YAWLIM
0396  REP   1              15,3022  1 3051 1           TCF   DZNOCOM

A0397                                                      BIASED DZ FOR EXT ATM DAP.
0398  REP   1              15,3023  55*624 1  BIASEDZ   TS    JETEM2     SAVE RATE/180. ERROR/180 IS IN L.
0399  REP 251  LAST 1046   15,3024  10 000 0           CCS   A          START ERROR DZ.
0400  REP   1              15,3025  4 3214 1           CS    CM/BIAS    = .6/180
0401                       15,3026  1 3030 0           TCF   +2
0402  REP   2  LAST 1046   15,3027  3 3214 0           CA    CM/BIAS
0403  REP 133  LAST 1036   15,3030  6 0001 0           AD    L          BIAS THE ERROR.
0404  REP 207  LAST 1036   15,3031  22 002 0           LXCH  Q          SAVE CALLERS RETURN ADDRESS.
0405  REP   1              15,3032  0 3016 0           TC    3DDZ       GO GENERATE THE ERROR BIT.
0406  REP 134  LAST 1046   15,3033  52 002 1           DXCH  L          BIT TO L, RESTORE CALLERS Q.
0407  REP   2  LAST 1046   15,3034  11*624 1  4D/SDZ   CCS   JETEM2     CAME HERE IN EXT ATM. C(L) = ERROR BIT
0408  REP   1              15,3035  6 3212 0           AD    4D/SLIM    IF RATE GEQ 4D/S, SET L=0 AND TAKE
0409                       15,3036  1 3040 1           TCF   +2         JET BITS ACCORDING TO SGN OF RATE.
0410  REP   2  LAST 1046   15,3037  6 3212 0           AD    4D/SLIM
0411  REP 252  LAST 1046   15,3040  54 000 0           TS    A
0412                       15,3041  1 3043 1           TCF   +2         RATE OK. CONTINUE
0413                       15,3042  22 007 0           ZL               RATE GEQ 4 D/S. OVER RIDE ERROR BIT
0414  REP   3  LAST 1046   15,3043  57*624 0           XCH   JETEM2     AND CONTINUE TO GET SIGN.

0415  REP 253  LAST 1046   15,3044  10 000 0  2D/SDZ   CCS   A          COME HERE TO TEST IF A WITHIN 2DEG/S DZ
0416  REP   1              15,3045  6 3213 1           AD    YDOTLIM    1.0 - YDOT DZ          ( OR PDOT)
0417                       15,3046  1 3051 1           TCF   +3
0418  REP   2  LAST 1046   15,3047  6 3213 1           AD    YDOTLIM    YDOT DZ = 2 DEG/SEC
0419                       15,3050  4 0000 0  DZCOM    COM
0420  REP  22  LAST 1045   15,3051  55*721 0  DZNOCOM  TS    JETEM +1   GENERATE TAG, SET C(A)= -+1 OUTSIDE DZ
0421  REP 197  LAST 1042   15,3052  3 4714 1           CA    ZERO       SET C(A) = +0 INSIDE
0422  REP 208  LAST 1046   15,3053  0 0002 0           TC    Q
```

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P0423           EXTRA ATMOSPHERIC DIGITAL AUTOPILOT

R0424           1.    IF ABS(CALP) -C(45) POS, USE                  IF CALFA POS; CMDAPMOD= +0
R0426             BETA'   YAW ERROR = SGN(CALP) (BETACOM -BETA)     IF CALFA NEG, CMDAPMOD =-0
R0428                       RATE = BETADOT                          IF CMDAPMOD =-0, RATE =  RREL
R0430                     R-AXIS = CONTROL

R0431             ROLL'   ROLL ERROR = SGN(CALP) (ROLLC - ROLL)     IF CMDAPMOD = -0, RATE DAMP ONLY.
R0433                       RATE = PREL
R0434                     P-AXIS = CONTROL

R0435           2.    IF C(45) GEQ CALFA GEQ -C(45), USE            CMDAPMOD = +1
R0437             BETA'   ROLL ERROR = SGN(-SALP) (BETACOM -BETA)
R0438                       RATE = BETADOT
R0439                     P-AXIS = CONTROL

R0440             ROLL'   YAW ERROR = SGN(SALP) (ROLLC -ROLL)       RATE DAMP ONLY.
R0442                       RATE = RREL
R0443                     R-AXIS = CONTROL

R0444           3.  FOR ALL CASES , USE
R0445             ALFA'   PITCH ERROR = (ALFACOM - ALFA)
R0446                       RATE = QREL
R0447                     Q-AXIS = CONTROL

R0448

 0449  REF   6  LAST 1045   15,3054  55#700 0  EXDAP  TS    CMDAPMOD  -  +0 FOR NOW
 0450  REF   7  LAST 1044   15,3055  4 1666 1        CS    BETA/180
 0451  REF   2  LAST  110   15,3056  6 1604 1        AD    BETACOM
 0452  REF  23  LAST 1046   15,3057  55#721 0        TS    JETEM +1    PRESERVE THIS FOR A WHILE.

 0453  REF   3  LAST 1044   15,3060  11#506 1        CCS   CALFA
 0454  REF   1              15,3061  6 3216 1        AD    C45LIM      =1.0-COS(45)
 0455                       15,3062  1 3064 1        TCF   +2
 0456  REF   2  LAST 1047   15,3063  6 3216 1        AD    C45LIM
 0457  REF 254  LAST 1046   15,3064  54 000 0        TS    A
 0458  REF   1              15,3065  1 3146 0        TCF   EXDAP2      HERE IF ABS(CALFA)  L  COS(45)

 04582 REF   4  LAST 1047   15,3066  11#506 1        CCS   CALFA       YCALFAY 5 0.707
 04583                      15,3067  1 3070 1        TCF   +1         CONTINUE IF POS
```

1047-A

```
0459  REF   4  LAST 1037   15,3070  11∝727 0        CCS   P63FLAG     VALID VALUES ARE'  -1, +1, +0.
0460  REF   1              15,3071  0 3104 1        TC    EXDAP4
0461                       15,3072  0 3074 1        TC    +2
0462  REF   2  LAST 1047   15,3073  0 3104 1        TC    EXDAP4
0463  REF  89  LAST 1035   15,3074  0 5301 0        TC    PHASCHNG    SINGLE PASS THROUGH HERE.
0464                       15,3075   40334 1        OCT   40334
0465  REF 118  LAST 1045   15,3076  4 4712 0        CS    ONE
0466  REF   5  LAST 1047   15,3077  55∝727 0        TS    P63FLAG     SET FLAG TO ASSURE SINGLE PASS.
```

```
 0467  REF   1                15,3100  3 3211 0          CA     NSEC
 0468  REF  48  LAST 1039     15,3101  0 5140 1          TC     WAITLIST
 0469  REF  39  LAST 1043     E6,1661                    EBANK= AOG
 0470  REF   2  LAST  209     15,3102   02374 0          2CADR  WAKEP62        CALL TO TERMINATE P62 IN N SEC.
 0470                         15,3103   54066 0
A0471                                                                          65 DEG/ 3DEG/SEC = 21 SEC NOMINAL
A0472                                                                          TRANSIT TIME FROM ALFA=45 TO ALFA TRIM.

 0473  REF   5  LAST 1045     15,3104  11∝711 0  EXDAP4  CCS    JETAG          ROLLJET INTERFACE TEST BETWEEN .1 SEC
 0474  REF   1                15,3105  1 3113 0          TCF    EXDAP3         DAP AND THE 2 SEC CM/RCS DAP
 0475  REF   2  LAST 1048     15,3106  1 3113 0          TCF    EXDAP3
 0476  REF 198  LAST 1046     15,3107  3 4714 1          CA     ZERO
 0477                         15,3110  0 0006 1          EXTEND                TURN OFF ROLL JETS IF ON AND WAIT
 0478  REF   2  LAST 1036     15,3111  01 006 0          WRITE  ROLLJETS       UNTIL START  OF 2 SEC CM/RCS CYCLE
 0479  REF   6  LAST 1048     15,3112  55∝711 0          TS     JETAG          RESTORE PROPER VALUE +0

A0480                                                                 ROLL FDAI WILL BE IN ERROR UNTIL NEXT CM/RCS CALL.
 0481  REF   5  LAST 1047     15,3113  11∝506 1  EXDAP3  CCS    CALFA          HERE IF ABS(CALFA) GEQ COS(45)
 0482  REF  24  LAST 1047     15,3114  3 1721 1          CA     JETEM +1
 0483  REF   1                15,3115  1 3121 1          TCF    EXDAP1
 0484  REF 199  LAST 1048     15,3116  4 4714 0          CS     ZERO
 0485  REF   7  LAST 1047     15,3117  55∝700 0          TS     CMDAPMOD       FOR CM/RCS
 0486  REF  25  LAST 1048     15,3120  4 1721 0          CS     JETEM +1
 0487  REF   1                15,3121  55∝573 0  EXDAP1  TS     RAXERR         FOR YAW FDAI
 0488  REF   9  LAST 1045     15,3122  55∝500 1          TS     AK2            WANT RAXERR FOR TM.
 0489  REF 135  LAST 1046     15,3123  54 001 1          TS     L
 0490  REF   8  LAST 1048     15,3124  11∝700 0          CCS    CMDAPMOD       COORDINATE BETA CONTROL.
 0491                         15,3125  0 3130 0          TC     +3             C(CMDAPMOD) CAN BE +1, +0, OR -0.
 0492  REF 119  LAST 1047     15,3126  3 4712 1          CA     ONE            USE BETADOT TO COORD IN MODE +0
 0493  REF 255  LAST 1047     15,3127  50 000 1          INDEX  A              OTHERWISE USE RREL.
 0494  REF   7  LAST 1045     15,3130  3 1703 1          CA     RREL
 0495  REF   1                15,3131  0 3023 0          TC     BIASEDZ        GO TEST DZ. +0 IF IN DZ, +-1 OTHERWISE
A0496                                                                          IF GEQ 4D/S, SET ERROR BIT IN L =0)
 0497                         15,3132  0 0006 1          EXTEND
 0498  REF  12  LAST  988     15,3133  04 001 1          ROR    LCHAN          L HAS BETA BIT
 0499  REF 256  LAST 1048     15,3134  50 000 1          INDEX  A
 0500  REF   2  LAST 1045     15,3135  3 3222 0          CAF    YJETCODE
 0501  REF  26  LAST 1048     15,3136  55∝720 1          TS     JETEM

 0502  REF   3  LAST 1045     15,3137  3 1572 0          CA     QAXERR         ALFA ERROR.
 0503  REF 136  LAST 1048     15,3140  54 001 1          TS     L
 0504  REF   6  LAST 1045     15,3141  3 1702 0          CA     QREL           FOR ALFADOT USE QREL
 0505  REF   2  LAST 1048     15,3142  0 3023 0          TC     BIASEDZ
 0506                         15,3143  0 0006 1          EXTEND
 0507  REF  13  LAST 1048     15,3144  04 001 1          ROR    LCHAN
 0508  REF   1                15,3145  1 3005 0          TCF    EXDAPIN        CONTINUE ON IN DAP

 0509  REF   9  LAST 1048     15,3146  25∝700 1  EXDAP2  INCR   CMDAPMOD       SET CMDAPMOD TO +1

 0510  REF 120  LAST 1048     15,3147  4 4712 0          CS     ONE            INDICATE CHANGE FROM .1 SEC UPDATE TO
```

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 0511   REF   7  LAST 1048   15,3150  55=711 0          TS    JETAG      TO 2 SEC FOR ROLL JETS.( IF CMDAPMOD
A0512                                                                    =0 AND JETAG =-1, QUENCHES JETS IF ON)

 0513   REF   6  LAST 1047   15,3151  11=727 0          CCS   P63FLAG    IF FLAG WAS +1,. SET =0.
 0514   REF   7  LAST 1049   15,3152  55=727 0          TS    P63FLAG
 0515                        15,3153  13 154 0          NOOP

 0516   REF   4  LAST 1044   15,3154  11=507 0          CCS   SALFA      BETA CONTROL WITH P JETS
 0517   REF  27  LAST 1048   15,3155   4 1721 0         CS    JETEM +1
 0518                        15,3156   1 3160 1         TCF   +2
 0519   REF  28  LAST 1049   15,3157   3 1721 1         CA    JETEM +1
 0520   REF   4  LAST 1037   15,3160  55=713 1          TS    PAXERR1    TEMP SAVE.  ERROR/180
 0521                        15,3161   0 0006 1         EXTEND
 0522   REF   5  LAST 1038   15,3162   7 4675 0         MP    HALF       CM/FDAI EXPECTS ERROR/360.
 0523   REF   5  LAST 1049   15,3163  57=713 0          XCH   PAXERR1    ERROR/360 FOR FDAI, GET ERROR/180.
 0524   REF 137  LAST 1048   15,3164  54 001 1          TS    L
 0525   REF   5  LAST 1049   15,3165  11=507 0          CCS   SALFA
 0526   REF   4  LAST 1044   15,3166   4 1704 1         CS    BETADOT    USE BETADOT TO COORD IN MODE +1
 0527                        15,3167   0 3171 0         TC    +2
 0528   REF   5  LAST 1049   15,3170   3 1704 0         CA    BETADOT
 0529   REF   3  LAST 1048   15,3171   0 3023 0         TC    BIASEDZ
 0530                        15,3172   0 0006 1         EXTEND
 0531   REF  14  LAST 1048   15,3173  04 001 1          ROR   LCHAN
 0532   REF 257  LAST 1048   15,3174  50 000 1          INDEX A
 0533   REF   2  LAST 1045   15,3175   3 3225 1         CAF   P/RJCODE   GET ROLL CODE
 0534                        15,3176   0 0006 1         EXTEND           ROLL CONTROL WITH YAW JETS.
 0535   REF   3  LAST 1048   15,3177  01 006 0          WRITE ROLLJETS   WE,LL SKIP REGULAR ROLL SYST

 0536   REF   3  LAST 1038   15,3200   3 1717 1         CA    ROLLHOLD   ROLL/180 AT CM/DAPON TIME.
 0537                        15,3201   0 0006 1         EXTEND
 0538   REF  10  LAST 1045   15,3202  21=664 0          MSU   ROLL/180   1,S COMPL, BUT SO WHATS A BIT.=
 0539   REF 138  LAST 1049   15,3203  54 001 1          TS    L          FORCE A LIMIT CYCLE IN YAW RATE.
 0540   REF   6  LAST 1049   15,3204  11=507 0          CCS   SALFA
 0541   REF 139  LAST 1049   15,3205   3 0001 0         CA    L          TO REMOVE ITS BIASING EFFECT ON M DOT.
 0542   REF   2  LAST 1048   15,3206   0 3121 0         TC    EXDAP1
 0543   REF 140  LAST 1049   15,3207   4 0001 1         CS    L
 0544   REF   3  LAST 1049   15,3210   0 3121 0         TC    EXDAP1

 0545                        15,3211   04064 1  NSEC    DEC   2100       65 DEG/ 3 DEG/SEC
A0546                                                                   IF NSEC IS CHANGED, REMEMBER TO CHANGE 4.33SPOT.
 0547                        15,3212   37734 0  4D/SLIM DEC   16348      1.0 -4/180 D/S = 4/1800 EXP 14
 0548                        15,3213   37756 1  YDOTLIM DEC   16366      =1.0 - YDOT DZ= 16384 -18
A0549                                                                   YDOT DZ = YDOT TCDU/180 = 2/1800 EXP 14

 0550                        15,3214   00067 0  CM/BIAS DEC   55         =.6/180 B14  = 55
 0551                        15,3215   37267 0  YAWLIM  DEC   16055      YAWLIM=1.0-3.6/180=16384-329=16055
 0552                        15,3216   11277 0  C45LIM  DEC   .29289    =1.0-COS(45)
R0553
 05531                       15,3217   65033 1  SINTRIM DEC   -.34202    SIN(-20)      (FOR NOMINAL L/D = .3)
 05532                       15,3220   36044 1  COSTRIM DEC    .93969    COS(-20)      (FOR NOMINAL L/D = .3)
```

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R05534 TO MAKE DAP INSENSITIVE TO PITCH ERRORS DUE TO ACCUMULATED NAV ERRORS,USE NOMINAL VALUE (-20 DEG) FOR TRIM ALFA
R05536 USED DURING ATMOSPHERIC COORDINATION. OUTSIDE ATMOSPHERE, NAV ERRORS WILL BE SLIGHT, BUT ALFA CAN DIFFER GREATLY
R05538 FROM TRIM, SO USE ON-BOARD ESTIMATES.
A0554

JET CODE TABLES FOLLOW

```
0555          15,3221   00120 1          OCTAL  00120      POS Y
0556          15,3222   00000 1  YJETCODE OCTAL  00000      RCS JET BITS
0557          15,3223   00240 1          OCTAL  00240      NEG Y
0558          15,3224   00005 1          OCTAL  00005      POS R JET BITS    ALSO POS P JET BITS
0559          15,3225   00000 1  P/RJCODE OCTAL  00000
0560          15,3226   00012 1          OCTAL  00012      NEG R             ALSO NEG P
```

```
P0561  RCS        THIS SECTION IS ENTERED EACH 2 SEC BY WAITLIST CALL FOLLOWING A DELAY OF 1.2 SEC AFTER PIPUP.
R0563  THE TASK SETJTAG  SETS A FLAG IN  JETAG  TO SIGNIFY THAT ROLL UPDATE IS DUE.  IN ROUGHLY 5 CS  BPDYRATE WILL BE
R0565  EXECUTED AND JETAG WILL CAUSE  CM/RCS  TO ACT ON ROLLC IMMEDIATELY THEREAFTER.  THE
R0567  TASK SAVES THE CALL TIME SO THAT CM/RCS CAN DETERMINE HOW MUCH OF THE 2 SEC INTERVAL REMAINS BEFORE THE
R0569  NEXT UPDATE.

 0570  REF  15  LAST 1039   15,3227  4 0025 1  SETJTAG  CS     TIME1          SAVE NOMINAL UPDATE TIME FOR SYNCH
 0571  REF   2  LAST  109   15,3230  55«712 0           TS     TUSED
A0572                                                                        THE 5 CS APPEARS IN TIMETST.
 0573  REF 121  LAST 1048   15,3231  3 4712 1           CA     ONE            RATHER THAN INCR, FOR SAFETY
 0574  REF   8  LAST 1049   15,3232  55«711 0           TS     JETAG          SET JETAG=1 TO CAUSE CM/RCS TO BE
 0575  REF  90  LAST 1047   15,3233  0 5301 0           TC     PHASCHNG
 0576                       15,3234   00001 0           OCT    00001

 0577  REF  54  LAST 1043   15,3235  0 5213 1           TC     TASKOVER       EXECUTED AFTER NEXT BODYRATE UPDATE

R0578  PREDICTIVE ROLL SYSTEM    ENTRY STEERING PROVIDES ROLL COMMAND IN LOC ROLLC. THE FOLLOWING CALCULATES THE
R0580  TRAJECTORY TO THE ORIGIN IN PHASE PLANE (X,V). PROGRAM ENTERS JET ON AND OFF CALLS INTO WTLST TO PRODUCE
R0582  THE DESIRED TRAJECTORY. ONLY THOSE CALLS WHICH CAN BE EXECUTED WITHIN THE INTERVAL T (2 SEC) ARE ENTERED IN
R0584  WTLST, THE REMAINDER ARE RECONSIDERED AT NEXT UPDATE.

 0585  REF   4  LAST  186        4674            HALFPR  EQUALS NEG1/2 +1

                                                                            CLEAR JETAG BEFORE TIMETST.  SET TO +0 TO SHOW
A0586                                                                       ROLL DAP CALLED.  IN EVENT OF RESTART, BODYRATE
A0587                                                                       MAY MISS A CYCLE.  CM/RCS WILL MISS A CYCLE ONLY
A0588                                                                       IF A RESTART OCCURS AFTER TIMETST COMMENCES..
A0589

 0590  REF 122  LAST 1051   15,3236  4 4712 0  CM/RCS  CS     ONE
 0591  REF   2  LAST  110   15,3237  55«617 1           TS     JNDX           SET NDX FOR POS ROLL, AND CHANGE LATER

 0592  REF   1              15,3240  4 4726 1           CS     2T/TCDU        ROLLDOT = DELACG + DELAIG SINM =DELR
 0593                       15,3241  0 0006 1           EXTEND
 0594  REF   7  LAST 1045   15,3242  7 1701 1           MP     PREL           DELR/180 = RDOT TCDU/180 = RDOT/1800
 0595  REF 141  LAST 1049   15,3243  6 0001 0           AD     L              -2 RDOT T/180 IN L
 0596  REF   2  LAST  110   15,3244  55«613 0           TS     -VT/180        SAVE -2VT/180 HERE

 0597  REF  11  LAST 1049   15,3245  4 1664 0           CS     ROLL/180
 0598  REF  12  LAST 1044   15,3246  54 021 0           TS     SR             SAVE (-R/180) /2

 0599  REF  21  LAST 1045   15,3247  4 0102 0           CS     CM/FLAGS
 0600  REF  38  LAST 1027   15,3250  7 4707 1           MASK   BIT4           LATSW = 101D BIT4
 0601                       15,3251  0 0006 1           EXTEND                 ROLL OVER TOP $
 0602  REF   1              15,3252  1 3260 1           BZF    GETLCX          NO, TAKE SHORTEST PATH
 0603  REF  22  LAST 1051   15,3253  26 102 0           ADS    CM/FLAGS        YES, ENFORCE ROLL OVER TOP.. (BIT =0)
 0604  REF  13  LAST 1038   15,3254  3 1715 0           CA     ROLLC           (ROLLC/180) /2
 0605  REF  13  LAST 1051   15,3255  6 0021 1           AD     SR              -(R/180) /2
 0606  REF   2  LAST  110   15,3256  57«614 0           XCH    LCX/360         DIFFERENT X REQD HERE. DISCONT AT 180.
 0607  REF   1              15,3257  1 3320 1           TCF    COMPAT          POSSIBLE OVFL ABOVE.
```

```
0608  REF   3  LAST 1039   15,3260  3 4675 1  GETLCX  CA      POS1/2        FORM RCOM/360
0609                       15,3261  6 0000 1          DOUBLE
0610  REF  14  LAST 1051   15,3262  6 1715 0          AD      ROLLC
0611  REF   3  LAST 1051   15,3263  57∝614 0          XCH     LCX/360       IGNORE POSSIBLE OVFL.

0612  REF  14  LAST 1051   15,3264  3 0021 1          CA      SR            FORM -R/360
0613  REF   5  LAST 1051   15,3265  6 4673 1          AD      NEG1/2
0614  REF   6  LAST 1052   15,3266  6 4673 1          AD      NEG1/2        IGNORE OVFL
0615  REF   4  LAST 1052   15,3267  57∝614 0          XCH     LCX/360       -R/360
0616  REF   5  LAST 1052   15,3270  27∝614 1          ADS     LCX/360       LCX/360 = RCOM/360 -R/360  RANGE (-1,1)

R0617  DOES SGN(-VT) (VT/180) (VT/180) (180/(4 A1 TT COSALFA)) + X/360 + SGN(X) / 2          OVFL  *

0619  REF   3  LAST 1051   15,3271  11∝613 0          CCS     -VT/180       TAKE SHORTEST ANGULAR PATH
0620  REF 123  LAST 1051   15,3272  6 4712 1          AD      ONE           (BASED ON SINGLE JET ACCELERATION)
0621                       15,3273  1 3275 0          TCF     +2
0622  REF 124  LAST 1052   15,3274  6 4712 1          AD      ONE
0623                       15,3275  0 0006 1          EXTEND
0624  REF   4  LAST 1052   15,3276  7 1613 0          MP      -VT/180       C(-VT/180) = -2 VT/180
0625                       15,3277  0 0006 1          EXTEND
0626  REF   1              15,3300  7 3767 0          MP      1/16A1        = 180/(16 A1 TT )
0627                       15,3301  0 0006 1          EXTEND
0628  REF   6  LAST 1048   15,3302  11∝506 1          DV      CALFA
0629  REF 142  LAST 1051   15,3303  54 001 1          TS      L
0630  REF   6  LAST 1052   15,3304  11∝614 1          CCS     LCX/360
0631  REF   4  LAST 1052   15,3305  3 4675 1          CAF     POS1/2
0632                       15,3306  1 3310 1          TCF     +2
0633  REF   5  LAST 1052   15,3307  4 4675 0          CS      POS1/2
0634  REF   7  LAST 1052   15,3310  6 1614 0          AD      LCX/360       IS LCX/360 LESS THAN 180 DEG  $
0635  REF 143  LAST 1052   15,3311  6 0001 0          AD      L
0636  REF 144  LAST 1052   15,3312  54 001 1          TS      L
0637  REF   2  LAST 1051   15,3313  1 3320 1          TCF     COMPAT        YES, GO ON.
0638  REF 258  LAST 1049   15,3314  50 000 1  TRTAGXPI INDEX   A             NO, SHIFT X BY - SGN(X) 2 PI
0639  REF   1              15,3315  4 4674 1          CS      HALFPR        +A YIELDS -1/2
0640                       15,3316  6 0000 1          DOUBLE
0641  REF   8  LAST 1052   15,3317  27∝614 1          ADS     LCX/360

0642  REF   9  LAST 1052   15,3320  3 1614 0  COMPAT  CA      LCX/360       CORRECT FOR ASSUMED COORD TURN.
0643                       15,3321  0 0006 1          EXTEND
0644  REF   7  LAST 1052   15,3322  7 1506 1          MP      CALFA         COS ALFA
0645  REF  10  LAST 1052   15,3323  55∝614 1          TS      LCX/360       SCALED LCX OK HERE.

0646  REF  10  LAST 1048   15,3324  11∝700 0          CCS     CMDAPMOD      FOUR POSSIBILITIES HERE
0647  REF   1              15,3325  0 3714 0          TC      DZCALL1       EXIT, SETTING JETAG=0.(C(A)=0)
A0648                                                                       ALL 3 AXES ALREADY DONE.
0649                       15,3326  0 3327 1          TC      +1            G LESS THAN .05. CA POS. CONTINUE
0650  REF  11  LAST 1052   15,3327  3 1614 0          CA      LCX/360       G GEQ .05. CONTINUE IN CM/RCS
0651  REF  12  LAST 1052   15,3330  55∝614 1          TS      LCX/360       CMDAPMOD=-0. DAMPING ONLY. SET LCX=0
0652  REF   6  LAST 1049   15,3331  55∝713 1          TS      PAXERR1       SAVE LCX FOR FDAI AND EDIT.(  /360)
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0653  REF   5  LAST 1052   15,3332  3 1613 1          CA      -VT/180        GET - 2 VT/180
0654  REF  15  LAST 1052   15,3333  54 021 0          TS      SR
0655  REF  16  LAST 1053   15,3334  3 0021 1          CA      SR             GET -VT/180, LEAVE -VT/360 IN SR FOR DZ
0656  REF   1              15,3335  55"570 0          TS      -VT/180E                                DIAGNOSTIC ****
0657  REF   6  LAST 1053   15,3336  57"613 1          XCH     -VT/180        NOW CONTENTS OF -VT/180 AS LABELED
0658                       15,3337  0 0006 1          EXTEND
0659  REF   7  LAST 1053   15,3340  7 1613 0          MP      -VT/180        B(A) = -2VT/180
0660                       15,3341  0 0006 1          EXTEND
0661  REF   1              15,3342  7 3767 0          MP      180/8ATT
0662  REF   2  LAST  110   15,3343  55"616 0          TS      VSQ/4API

R0663    IS SGN(VT) ( (180/4A1 TT) VT/180 VT/180 - .5 BUFLIM/360 ) -X/360     - .5 BUFLIM/360   POS ?

0665                       15,3344  6 0000 1  WHICHALF DOUBLE                  FOR SECOND BURN, A1
0666                       15,3345  4 0000 0          COM
0667  REF   1              15,3346  6 3773 1          AD      BUFLIM         =BUFLIM/(2 360)
0668  REF 145  LAST 1052   15,3347  54 001 1          TS      L
0669  REF   8  LAST 1053   15,3350  11"613 0          CCS     -VT/180
0670  REF 146  LAST 1053   15,3351  4 0001 1          CS      L
0671                       15,3352  1 3354 1          TCF     +2
0672  REF 147  LAST 1053   15,3353  3 0001 0          CA      L
0673  REF  13  LAST 1052   15,3354  6 1614 0          AD      LCX/360
0674  REF   2  LAST 1053   15,3355  6 3773 1          AD      BUFLIM
0675                       15,3356  0 0006 1          EXTEND
0676  REF   1              15,3357  6 3374 1          BZMF    REFLECT        POINT (X,V) IN LHP.

R0677    IS SGN(VT) ( (180/4A1 TT) VT/180 VT/180 - .5 BUFLIM/360 ) -X/360     + .5 BUFLIM/360   NEG ?

0679                       15,3360  4 0000 0          COM
0680  REF   3  LAST 1053   15,3361  6 3773 1          AD      BUFLIM
0681  REF   4  LAST 1053   15,3362  6 3773 1          AD      BUFLIM
0682                       15,3363  0 0006 1          EXTEND
0683  REF   1              15,3364  6 3403 0          BZMF    DZ1            POINT (X,V) IN RHP.

R0684    IS POINT WITHIN VELOCITY DZ ?

0685  REF   1              15,3365  4 3766 1          CS      VSQMIN         IS VSQ/4API - (VSQ/4API) MIN  NEG ?
0686  REF   3  LAST 1053   15,3366  6 1616 1          AD      VSQ/4API
0687                       15,3367  0 0006 1          EXTEND
0688  REF   1              15,3370  6 3676 0          BZMF    DZCALL         YES.

R0689          POINT IS IN BUFFER ZONE. THRUST TO X AXIS.

0690  REF   3  LAST 1051   15,3371  4 1617 1          CS      JNDX
0691  REF   2  LAST  111   15,3372  55"620 0          TS      JNDX1
0692  REF   1              15,3373  0 3456 0          TC      OVRLINE1

0699  REF   9  LAST 1053   15,3374  4 1613 0  REFLECT CS      -VT/180        REFLECT LHP INTO RHP REL TO TERM CONTR
0700  REF  10  LAST 1053   15,3375  55"613 0          TS      -VT/180
0701  REF  17  LAST 1053   15,3376  54 021 0          TS      SR             -VT/360  SAVED FOR DZ.
```

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L       CM ENTRY DIGITAL AUTOPILOT

 0702   REF  14  LAST 1053   15,3377  4 1614 1          CS    LCX/360
 0703   REF  15  LAST 1054   15,3400  55=614 1          TS    LCX/360
 0704   REF   4  LAST 1053   15,3401  4 1617 1          CS    JNDX
 0705   REF   5  LAST 1054   15,3402  55=617 1          TS    JNDX

R0706    IS VSQ/4API - (VSQ/4API) MIN  NEG   $

 0707   REF   2  LAST 1053   15,3403  4 3766 1  DZ1     CS    VSQMIN      IS VSQ/4API - (VSQ/4API) MIN  NEG  $
 0708   REF   4  LAST 1053   15,3404  6 1616 1          AD    VSQ/4API
 0709                        15,3405  0 0006 1          EXTEND
 0710   REF   1              15,3406  6 3410 1          BZMF  DZ2         YES, GO TEST FURTHER.
 0711   REF   1              15,3407  1 3415 0          TCF   MAXVTEST    NO

R0712    IS X/360 - XMIN/360 -V1/360  NEG   $

 0713   REF   1              15,3410  4 3771 1  DZ2     CS    XMIN/360    XMIN/360 = 4/360
 0714   REF  16  LAST 1054   15,3411  6 1614 0          AD    LCX/360
 0715   REF  18  LAST 1053   15,3412  6 0021 1          AD    SR          C(SR) = -VT/360
 0716                        15,3413  0 0006 1          EXTEND            IS X/360 - XMIN/360 -VT/360  NEG  $
 0717   REF   2  LAST 1053   15,3414  6 3676 0          BZMF  DZCALL      YES, IN DZ. EXIT SETTING JETAG=0.

R0718    IS XD/360 - VM/360K - XS/360   POS   *

 0719   REF   6  LAST 1054   15,3415  4 1617 1  MAXVTEST CS    JNDX
 0720   REF   3  LAST 1053   15,3416  55=620 0          TS    JNDX1       NOW CAN SET JNDX1 FOR TON2 JETS.
 0721   REF   1              15,3417  4 3773 0          CS    XS/360      XS/360 = (XMIN -YMIN/K) /360
 0722   REF   5  LAST 1054   15,3420  6 1616 1          AD    VSQ/4API
 0723   REF  17  LAST 1054   15,3421  6 1614 0          AD    LCX/360
 0724   REF   2  LAST  110   15,3422  55=615 0          TS    XD/360      XD/360= X/360 +VSQ/4API   X INTERCEPT
A0725                                                                     BUT C(XD/360) = (XD - XS) /360
 0726   REF   1              15,3423  6 3772 0          AD    -VM/360K    X INTERCEPT FOR MAX V (VM)
 0727                        15,3424  4 0000 0          COM
 0728                        15,3425  0 0006 1          EXTEND
 0729   REF   1              15,3426  6 3434 1          BZMF  MAXVTIM1    YES, THRUST TO VM
 0730   REF   3  LAST 1054   15,3427  3 1615 1          CA    XD/360
 0731                        15,3430  0 0006 1          EXTEND
 0732   REF   1              15,3431  7 4675 0          MP    KTRCS
 0733                        15,3432  20 001 1          DDOUBL            GO SAVE PREDICTED DRIFTING VELOCITY.

 0734   REF   1              15,3433  0 3437 1          TC    GETON1      INSURE THAT Q IS POS AS TAG.
 0735                        15,3434  0 0006 1  MAXVTIM1 EXTEND
 0736                        15,3435  22 007 0          ZQ                SET +0 AS TAG
 0737   REF   1              15,3436  4 3772 1          CS    -VMT/180
 0738   REF   1              15,3437  55=567 0  GETON1  TS    VDT/180     VDT/180 OR VMT/180.
 0739   REF  11  LAST 1053   15,3440  6 1613 1          AD    -VT/180
 0740                        15,3441  6 0000 1          DOUBLE
 0741                        15,3442  0 0006 1          EXTEND
 0742   REF   2  LAST 1053   15,3443  7 3767 0          MP    180/8ATT
 0743   REF   2  LAST  111   15,3444  55=621 1          TS    TON1        TON1 / 4T
```

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0744                          15,3445  0 0006 1          EXTEND
0745  REF   1                 15,3446  6 3450 0          BZMF    OVRLINE
0746  REF   1                 15,3447  0 3462 1          TC      GETON2          RESET Q POS IF CAME FROM MAXVTIM1

0747  REF 209  LAST 1046      15,3450  10 002 1 OVRLINE  CCS     Q
0748  REF   2  LAST 1053      15,3451  1 3456 1          TCF     OVRLINE1
0749  REF   4  LAST 1054      15,3452  3 1620 1 MAXVTIM2 CA      JNDX1           ABOVE VM, SO THRUST DOWN
0750  REF   7  LAST 1054      15,3453  55=617 1          TS      JNDX
0751  REF   3  LAST 1054      15,3454  4 1621 1          CS      TON1
0752  REF   1                 15,3455  1 3461 0          TCF     OVRLINE2 +1

0753  REF  12  LAST 1054      15,3456  4 1613 0 OVRLINE1 CS      -VT/180         DRIFT AT V
0754  REF   2  LAST 1054      15,3457  55=567 0          TS      VDT/180
0755  REF 200  LAST 1048      15,3460  3 4714 1 OVRLINE2 CA      ZERO
0756  REF   4  LAST 1055      15,3461  55=621 1          TS      TON1
0757  REF   3  LAST 1055      15,3462  3 1567 1 GETON2   CA      VDT/180         VDT/180, OR VMT/180 OR VT/180
0758                          15,3463  6 0000 1          DOUBLE
0759                          15,3464  0 0006 1          EXTEND
0760  REF   3  LAST 1054      15,3465  7 3767 0          MP      180/8ATT
0761                          15,3466  6 0000 1          DOUBLE          FOR SECOND BURN, A1
0762  REF   2  LAST  110      15,3467  55=607 0          TS      TON2            = TON2 / 4T

0763                          15,3470  4 0000 0          COM
0764                          15,3471  0 0006 1          EXTEND
0765  REF   1                 15,3472  6 3476 1          BZMF    GETOFF
0766  REF   3  LAST 1055      15,3473  55=607 0          TS      TON2
07661 REF   8  LAST 1055      15,3474  3 1617 0          CA      JNDX
07662 REF   5  LAST 1055      15,3475  55=620 0          TS      JNDX1

0767  REF   4  LAST 1055      15,3476  4 1607 0 GETOFF   CS      TON2            TON2 / 4T
0768                          15,3477  0 0006 1          EXTEND
0769  REF   4  LAST 1055      15,3500  7 1567 0          MP      VDT/180         VDT/180, OR VT/180, OR VMT/180.
0770  REF   4  LAST 1054      15,3501  55=615 0          TS      XD/360          USE AS TEMP
0771  REF   5  LAST 1055      15,3502  4 1567 0          CS      VDT/180
07711                         15,3503  0 0006 1          EXTEND
07712 REF   1                 15,3504  1 3520 1          BZF     TOFFOVFL        OMIT THE DIVIDE IF DEN = 0.
0772  REF  13  LAST 1055      15,3505  6 1613 1          AD      -VT/180
0773                          15,3506  0 0006 1          EXTEND
0774  REF   5  LAST 1055      15,3507  7 1621 1          MP      TON1            TON1 /4T
0775  REF   5  LAST 1055      15,3510  6 1615 1          AD      XD/360          TEMP = -VDT/180 / 2 TON2
0776  REF  18  LAST 1054      15,3511  6 1614 0          AD      LCX/360
0777                          15,3512  22 007 0          ZL
0778  REF 148  LAST 1053      15,3513  56 001 0          XCH     L               TEST THE DIVIDE
0779                          15,3514  0 0006 1          EXTEND
0780  REF   6  LAST 1055      15,3515  11=567 0          DV      VDT/180
0781                          15,3516  0 0006 1          EXTEND
0782  REF   1                 15,3517  1 3522 0          BZF     GETOFF2         DIVIDE OK

0787  REF   1                 15,3520  3 4740 0 TOFFOVFL CA      2JETT           OVFL, USE  2T  FOR CONVENIENCE.
0788  REF   1                 15,3521  1 3527 0          TCF     TIMSCAL
```

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0796  REF 149  LAST 1055   15,3522  56 001 0  GETOFF2  XCH   L          GET NUMERATOR.
0797                       15,3523  0 0006 1           EXTEND
0798  REF   7  LAST 1055   15,3524  11∝567 0           DV    VDT/180    C(A) = TOFF / 2T
0799                       15,3525  0 0006 1           EXTEND
0800  REF   2  LAST 1055   15,3526  7 4740 1           MP    2JETT
0801  REF   2  LAST  110   15,3527  55∝605 1  TIMSCAL  TS    TOFF       IN CS

0802  REF   1              15,3530  3 3770 1           CAF   4JETT
0803                       15,3531  0 0006 1           EXTEND
0804  REF   6  LAST 1055   15,3532  7 1621 1           MP    TON1       C(TON1) = TON1 / 4T
0805  REF   7  LAST 1056   15,3533  55∝621 1           TS    TON1       IN CS

0806  REF   2  LAST 1056   15,3534  3 3770 1           CAF   4JETT
0807                       15,3535  0 0006 1           EXTEND
0808  REF   5  LAST 1055   15,3536  7 1607 0           MP    TON2       C(TON2) = TON2 / 4T
0809  REF   6  LAST 1056   15,3537  55∝607 0           TS    TON2       IN CS

0810  REF 201  LAST 1055   15,3540  3 4714 1           CA    ZERO       CANNOT REDO AFTER TIMETST. TUSED GONE
0811  REF   9  LAST 1051   15,3541  55∝711 0           TS    JETAG      SET +0 TO SHOW ROLL DAP CALLED.

A0812                                                                  CAUSE THE TM OF BODY RATES VIA UPBUFF TO BE
A0813                                                                  INITIALIZED. ALSO CAUSE NEEDLES TO BE DONE ON NEXT
A0814                                                                  AND ON ALTERNATE PASSES THROUGH CM/DUMPR.

0815  REF 125  LAST 1052   15,3542  3 4712 1           CA    ONE
0816  REF   2  LAST 1039   15,3543  54 305 0           TS    SW/NDX
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P0817   TIMETEST SECTION FOR RCS
R0818   ENTER WITH THREE TIME INTERVALS AND THE CORRESPONDING JET CODE INDEXES IN ERASEABLE LOCS TON1, TOFF, TON2, JNDX
R0820   JNDX1.  SECTION PROCESSES TIME INTERVALS FOR WTLST CALLS AND ASSURES THAT WTLST CALLS ARE MADE ONLY
R0822   (1) FOR POS INTERVALS GREATER THAN A SPECIFIED MINIMUM ( HERE CHOSEN AS  2 CS) AND
R0824   (2) FOR THE INTERVALS THAT WILL BE EXECUTED WITHIN THE TIME REMAINING IN THE SAMPLE INTERVAL T  (2 SEC).
R0826   TIMETST  ESTABLISHES 6 LOCS CONTAINING JET CODES AND CORRESPONDING TIME  INTERVALS. THUS' TON1, T1BITS,
R0828   TOFF, TBITS,  TON2, T2BITS.   OF THESE THE FIRST 2 LOCS ARE TEMPORARY, FOR IMMEDIATE ACTION, IN GENERAL.
R0830   SECTION JETCALL  BELOW PROCESSES THIS LIST.

 0831   REF  16  LAST 1051   15,3544  3 0025 0  TIMETST  CA    TIME1          CORRECT FOR POSSIBLE TIME1 OVFL.
 0832   REF   6  LAST 1052   15,3545  6 4675 1           AD    POS1/2
 0833   REF   7  LAST 1057   15,3546  6 4675 1           AD    POS1/2         OVFL GUARANTEED.
 0834   REF   3  LAST 1051   15,3547  27«712 0           ADS   TUSED          B(TUSED) =-TUSED =-OLTIME1

 0835   REF   1              15,3550  3 3765 0           CA    -T-3           =-T +2 -5  (SEE SETJTAG)
A0836                                                                       THE +2 REQUIRED FOR PROPER BRANCH.
 0837   REF   4  LAST 1057   15,3551  27«712 0           ADS   TUSED          TUSED = TIME(K)-TIME(K-1)-T+2

 0838   REF  48  LAST 1014   15,3552  4 4711 0           CS    TWO            USE 2 SINCE TIME3 UNCERTAIN TO 1
 0839   REF   8  LAST 1056   15,3553  6 1621 0           AD    TON1
 0840                        15,3554  0 0006 1           EXTEND
 0841   REF   1              15,3555  6 3567 0           BZMF  TIMETST1
 0842   REF   9  LAST 1055   15,3556  51«617 0          INDEX JNDX
 0843   REF   3  LAST 1049   15,3557  3 3225 1           CAF   P/RJCODE
 0844   REF   2  LAST  111   15,3560  55«622 1           TS    T1BITS

 0845   REF   9  LAST 1057   15,3561  3 1621 0           CA    TON1
 0846   REF   5  LAST 1057   15,3562  27«712 0           ADS   TUSED
 0847                        15,3563  0 0006 1           EXTEND
 0848   REF   1              15,3564  6 3571 1           BZMF  TOFFTEST
 0849   REF 202  LAST 1056   15,3565  3 4714 1           CA    ZERO
 0850   REF   1              15,3566  1 3622 0           TCF   TIMETST3
 0851   REF 126  LAST 1056   15,3567  4 4712 0  TIMETST1 CS    ONE
 0852   REF  10  LAST 1057   15,3570  55«621 1           TS    TON1
 0853   REF  49  LAST 1057   15,3571  4 4711 0  TOFFTEST CS    TWO
 0854   REF   3  LAST 1056   15,3572  6 1605 0           AD    TOFF
 0855                        15,3573  0 0006 1           EXTEND
 0856   REF   1              15,3574  6 3603 1           BZMF  TIMETST2
 0857   REF   4  LAST 1057   15,3575  3 1605 0           CA    TOFF
 0858   REF   6  LAST 1057   15,3576  27«712 0           ADS   TUSED
 0859                        15,3577  0 0006 1           EXTEND
 0860   REF   1              15,3600  6 3605 1           BZMF  TON2TEST
 0861   REF 203  LAST 1057   15,3601  3 4714 1           CA    ZERO
 0862   REF   1              15,3602  1 3624 0           TCF   TIMETST4
 0863   REF 127  LAST 1057   15,3603  4 4712 0  TIMETST2 CS    ONE
 0864   REF   5  LAST 1057   15,3604  55«605 1           TS    TOFF
 0865   REF  50  LAST 1057   15,3605  4 4711 0  TON2TEST CS    TWO
 0866   REF   7  LAST 1056   15,3606  6 1607 1           AD    TON2
 0867                        15,3607  0 0006 1           EXTEND
 0868   REF   1              15,3610  6 3625 0           BZMF  TIMETST5
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0869  REP   6  LAST 1055   15,3611  51=620 1            INDEX  JNDX1
0870  REP   4  LAST 1057   15,3612  3 3225 1            CAP    P/RJCODE
0871  REP   2  LAST  110   15,3613  55=610 0            TS     T2BITS
0872  REP   8  LAST 1057   15,3614  3 1607 1            CA     TON2
0873  REP   7  LAST 1057   15,3615  27=712 0            ADS    TUSED
0874                       15,3616  0 0006 1            EXTEND
0875  REP   1               15,3617  6 3627 1            BZMF   JETCALL1
0876  REP 204  LAST 1057   15,3620  3 4714 1            CA     ZERO
0877  REP   2  LAST 1057   15,3621  1 3626 1            TCF    TIMETST5 +1
0878  REP  11  LAST 1057   15,3622  55=621 1  TIMETST3   TS     TON1
0879  REP 128  LAST 1057   15,3623  4 4712 0            CS     ONE
0880  REP   6  LAST 1057   15,3624  55=605 1  TIMETST4   TS     TOFF
0881  REP 129  LAST 1058   15,3625  4 4712 0  TIMETST5   CS     ONE
0882  REP   9  LAST 1058   15,3626  55=607 0            TS     TON2

R0883  SECTION  JETCALL  EXAMINES CONTENTS OF JET TIMES IN LIST, ESTABLISHES WTLST ENTRIES, AND EXECUTES CORRESPONDING
R0885  JET CODES. A POSITIVE NZ NUMBER IN A TIME REGISTER INDICATES THAT A WTLST CALL IS TO BE MADE, AND ITS JET BITS
R0887  EXECUTED. A +0 INDICATES THAT THE TIME INTERVAL DOES NOT APPLY, BUT THE CORRESPONDING JET BITS ARE TO BE
R0889  EXECUTED. A NEG NUMBER INDICATES THAT THE TIME INTERVAL HAS BEEN PROCESSED. IN EVENT OF +0 OR -1, THE
R0891  SUBSEQUENT TIME REGISTER IS EXAMINED FOR POSSIBLE ACTION. THUS JET BITS TO BE EXECUTED MAY COME FROM MORE
R0893  THAN ONE REGISTER.

0894  REP 205  LAST 1058   15,3627  3 4714 1  JETCALL1  CA     ZERO
0895  REP   2  LAST  110   15,3630  55=611 1            TS     OUTTAG
0896  REP   2  LAST  110   15,3631  55=612 1            TS     NUJET
0897  REP   2  LAST  110   15,3632  55=606 1            TS     TBITS
0898  REP  12  LAST 1058   15,3633  53=622 1            DXCH   TON1
0899  REP 259  LAST 1052   15,3634  10 000 0            CCS    A
0900  REP   1               15,3635  1 3652 1            TCF    JETCALL2        CALL WTLST
0901  REP   3  LAST 1058   15,3636  23=612 0  JETCALL3  LXCH   NUJET           WTLST ENTRIES COME HERE FROM JETCALL
0902  REP 130  LAST 1058   15,3637  4 4712 0            CS     ONE
0903  REP   7  LAST 1058   15,3640  53=606 1            DXCH   TOFF
0904  REP 260  LAST 1058   15,3641  10 000 0            CCS    A
0905  REP   2  LAST 1058   15,3642  1 3652 1            TCF    JETCALL2        CALL WTLST
0906  REP   4  LAST 1058   15,3643  23=612 0            LXCH   NUJET
0907  REP 131  LAST 1058   15,3644  4 4712 0            CS     ONE
0908  REP  10  LAST 1058   15,3645  53=610 0            DXCH   TON2
0909  REP 261  LAST 1058   15,3646  10 000 0            CCS    A
0910  REP   3  LAST 1058   15,3647  1 3652 1            TCF    JETCALL2        CALL WTLST
0911  REP   5  LAST 1058   15,3650  23=612 0            LXCH   NUJET
0912  REP   1               15,3651  0 3661 0            TC     JETACTN         C(A) = +0
0913  REP 150  LAST 1056   15,3652  56 001 0  JETCALL2  XCH    L               SAVE JET BITS FOR AFTER WTLST CALL
0914  REP   6  LAST 1058   15,3653  27=612 1            ADS    NUJET
0915  REP 151  LAST 1058   15,3654  56 001 0            XCH    L
0916  REP 132  LAST 1058   15,3655  6 4712 1            AD     ONE             RESTORE FOR CCS
0917  REP  49  LAST 1048   15,3656  0 5140 1            TC     WAITLIST
0918  REP  40  LAST 1048   E6,1661                      EBANK= ACC
0919  REP   1               15,3657   03667 0           2CADR  JETCALL
0919  REP   1               15,3660   32066 0
0920  REP   7  LAST 1058   15,3661  3 1612 0  JETACTN   CA     NUJET           COME HERE WHEN DESIRED JET CODE IS KNOWN
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 0921                          15,3662  0 0006 1          EXTEND                NO NEED TO SAVE OLD CODES
 0922   REF   4  LAST 1049     15,3663  01 006 0          WRITE   ROLLJETS      SET RCHAN TO NEW BIT CONFIG.

 0923   REF   3  LAST 1058     15,3664  11α611 1          CCS     OUTTAG
 0924   REF  55  LAST 1051     15,3665  0 5213 1          TC      TASKOVER
 0925   REF   2  LAST 1045     15,3666  0 3724 0  ROLLDUMP TC     CM/FDAIR

A0926                                                          EDIT DUMP AT ABOVE LOCATION.

R0927    WAITLIST ENTRIES COME HERE.

 0928   REF  42  LAST  982     15,3667  3 4711 1  JETCALL  CAF     BIT2          CM/DSTBY =103D BIT2
 0929   REF   4  LAST 1059     15,3670  55α611 1          TS      OUTTAG        SIGNIFY WTLST ENTRY
 0930   REF  23  LAST 1051     15,3671  7 0102 0          MASK    CM/FLAGS      IS SYSTEM DISABLED  $
 0931                          15,3672  0 0006 1          EXTEND
 0932   REF   2  LAST 1058     15,3673  1 3662 1          BZF     JETACTN +1    YES, QUENCH ROLL JETS,IF ON AND EXIT.
 0933                          15,3674  22 007 0          ZL                    NO, CONTINUE.
 0934   REF   1                15,3675  1 3636 0          TCF     JETCALL3      C(A) POS, C(L) =+0

R0935     DEAD ZONE ENTRIES COME HERE.

 09351  REF  11  LAST 1052     15,3676  4 1700 0  DZCALL   CS      CMDAPMOD      POSSIBLE VALUES OF CMDAPMOD' -1, +0, -0.
 09352  REF  73  LAST 1038     15,3677  7 4712 0          MASK    BIT1
 09353  REF 152  LAST 1058     15,3700  54 001 1          TS      L             C(L)=0 FOR -0
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1059-A

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09354  REF 262  LAST 1058   15,3701  50 000 1          INDEX  A          ERASBLE ORDER' ROLLTM,ROLLC,ROLLC +1.
09355  REF   4  LAST 1045   15,3702  3 1714 1          CA     ROLLTM     GET ROLL/180 OR ROLLC  (/360).
09356  REF 153  LAST 1059   15,3703  50 001 0          INDEX  L
09357  REF 263  LAST 1059   15,3704  54 000 0          TS     A          IF C(L)=1, STORE αROLLCα IN αLα.
09358  REF 154  LAST 1059   15,3705  6 0001 0          AD     L          (BOTH MUST BE SCALED DEG/180)
09359  REF   5  LAST 1045   15,3706  0 2542 0          TC     ANGOVCOR   C(A)=ROLL/180  OR  2 ROLLC  .
0936   REF   4  LAST 1049   15,3707  55α717 0          TS     ROLLHOLD   IF CMDAPMOD =-0, SAVE ROLL ANGLE,
A09361                                                                       OTHERWISE, SAVE ROLL COMMAND.

09362  REF 206  LAST 1058   15,3710  3 4714 1          CA     ZERO       COME HERE IF IN DZ, AND CANCEL JETS.
0937                        15,3711  0 0006 1          EXTEND             INHINT NOT NEEDED HERE.
0938   REF   5  LAST 1059   15,3712  01 006 0          WRITE  ROLLJETS   TURN OFF ALL ROLL JETS.
0939   REF   8  LAST 1056   15,3713  55α567 0          TS     VDT/180    SET =0 TO SHOW IN DEAD ZONE.
0940   REF  10  LAST 1056   15,3714  55α711 0  DZCALL1  TS     JETAG      COME HERE WITH C(A)=0.
0941   REF   1              15,3715  0 3666 1          TC     ROLLDUMP
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L CM ENTRY DIGITAL AUTOPILOT USER=S PAGE NO. 27 E6 S3

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P0942   CM ENTRY FDAI DISPLAY

R0943   CALCULATE BY INTEGRATION THE ROLL ERROR BETWEEN THE 2 SEC CM/RCS UPDATES . DISPLAY ATTITUDE ERRORS AS FOLLOWS'
R0945           ATM DAP'    DISPLAY ONLY ROLL ATTITUDE ERROR.
R0946           EXT ATM DAP'    PRESENT 3 ATTITUDE ERRORS RELATIVE TO THE APPROPRIATE BODY AXES EACH .1 SEC.
R0948                                   ROLL    ROLLC-ROLL
R0949                                   PITCH   ALPAC-ALPA
R0950                                   YAW     BETAC-BETA

R0951   DURING ENTRY, THE FDAI NEEDLES HAVE FULL SCALE OF 67.5 DEG IN ROLL AND  16.875 DEG IN PITCH AND YAW.
R0953   THE SUBROUTINE  NEEDLER  EXPECTS (ANGLE/180) AND SCALES TO 16.875 DEG   FULL SCALE.

A0958                                                   COME HERE EACH .1 SEC. (CMDAPMOD=+1 COMES BELOW)
 0959   REF   7  LAST 1045    15,3716  4 1705 0  CM/FDAI  CS      PHIDOT          INTEGRATE ROLL ERROR «TWEEN 2SEC UPDATES
 0960                         15,3717  0 0006 1           EXTEND
 0961   REF   8  LAST 1052    15,3720  7 1506 1           MP      CALPA           FOR ASSUMED COORDINATION.
 0962                         15,3721  0 0006 1           EXTEND
 0963   REF   6  LAST 1049    15,3722  7 4675 0           MP      HALF
 0964   REF   7  LAST 1052    15,3723  27«713 1           ADS     PAXERR1         ROLL ERROR/360.    OVFL OK.

A0965                                                   EDIT DUMP AT ABOVE LOCATION.
 0966   REF   7  LAST 1060    15,3724  3 4675 1  CM/FDAIR CA      HALF
 0967                         15,3725  0 0006 1           EXTEND
 0968   REF   8  LAST 1060    15,3726  7 1713 1           MP      PAXERR1         FULL SCALE FOR FDAI (ROLL) IS 67.5 D
 0969   REF   1                15,3727  55«476 1           TS      PAXERR          .25 (ROLL ERROR/180) FOR FDAI NEEDLE.

A0970                                                   PROGRAM TO FILE BODY  RATES FOR TM ON ONE PASS AND
A0971                                                   TO UPDATE THE NEEDLE DISPLAY ON THE NEXT.
A0972                                                   SYNCHRONIZATION WITH CM/RCS IS USED SO THAT THE TM
A0973                                                   IS DONE WITH THE ROLL SYSTEM AND NEEDLES START ON
A0974                                                   THE SUBSEQUENT PASS.
A0975

 0976   REF   3  LAST 1056    15,3730  4 0305 0  CM/DUMPR CS      SW/NDX          COMBINED ALTERNATION SWITCH AND FILE
 09761  REF   4  LAST 1060    15,3731  54 305 0           TS      SW/NDX
 0977                         15,3732  0 0006 1           EXTEND                  INDEX.
 0978   REF   1                15,3733  6 3737 1           BZMF    CMTMFILE        FILE STARTS WITH SW/NDX +1 AND GOES TO
A0979                                                                           ENDBUF.
A0980                                                                           INDEX IS POS FOR NEEDLES

 0981   REF  38  LAST  985    15,3734  0 4633 0           TC      IBNKCALL
 0982   REF   9  LAST  983    15,3735   42404 1           CADR    NEEDLER

 0983   REF   1                15,3736  0 3755 0           TC      CM/END

A0984                                                                           INDEX IS NEG FOR TM FILE

 0985   REF  39  LAST 1035    15,3737  6 6214 0  CMTMFILE AD      THREE
 0986                         15,3740  0 0006 1           EXTEND
 0987   REF   1                15,3741  6 3745 1           BZMF    SAVENDX
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 0988   REF  17  LAST 1057   15,3742  3 0025 0          CA     TIME1          INITIALIZE THE TM LIST IN UPBUFF.
 0989   REF   3  LAST   70   15,3743  54 304 1          TS     CMTMTIME
 0990   REF   3  LAST  825   15,3744  4 4720 1          CS     THIRTEEN        INITIALIZE COUNTER
 0991   REF   5  LAST 1060   15,3745  54 305 0 SAVENDX  TS     SW/NDX         A NEGATIVE NUMBER.
 0992                        15,3746  0 0006 1          EXTEND
 0993   REF   8  LAST 1051   15,3747  3 1702 0          DCA    PREL
 0994   REF   6  LAST 1061   15,3750  50 305 1          INDEX  SW/NDX
 0995   REF   2  LAST   70   15,3751  52 324 0          DXCH   ENDBUF -1
 0996   REF   8  LAST 1048   15,3752  3 1703 1          CA     RREL
 0997   REF   7  LAST 1061   15,3753  50 305 1          INDEX  SW/NDX
 0998   REF   3  LAST 1061   15,3754  54 325 1          TS     ENDBUF +1

 0999   REF   3  LAST 1044   15,3755  3 1623 1  CM/END  CA     CM/SAVE
 1000   REF  19  LAST 1054   15,3756  54 021 0          TS     SR
A1001                                                        DOES NOT PROTECT TEMK, SQ IN SPSIN/COS

 1002                        15,3757  0 0006 1          EXTEND
 1003   REF   1              15,3760  3 3764 1          DCA    T5IDLER2
 1004   REF  25  LAST 1043   15,3761  53=313 0          DXCH   T5LOC
 1005   REF  46  LAST 1033   15,3762  0 5222 0          TC     RESUME

 1006   REF  26  LAST 1061      1312                    EBANK= T5LOC
 1007   REF   7  LAST 1040   15,3763   03143 1 T5IDLER2 2CADR  T5IDLOC
 1007                        15,3764   12062 0
A1008                                                        DEFINE THE FOLLOWING 17D REGISTERS IN UPBUFF TO BE
A1009                                                        USED TO TELEMETER CM VEHICLE BODY RATE INFORMATION.
A1010                                                        THE INFORMATION IS FILED EACH 0.2 SEC, GIVING 15D
A1011                                                        DATA POINTS EACH 1 SEC.  TM LIST IS READ TWICE
A1012                                                        EACH 2 SECONDS.

A1013                                                        THE SEQUENCE IS'   SP TIME      INITIAL TIME
A1014                                                                           SWITCH       ALSO INDEX.
A1015                                                                           P            ROLL RATE
A1016                                                                           Q            PITCH RATE
A1017                                                                           R            YAW RATE
A1018                                                                           ETC.

A1019                                                CMTMTIME =     UPBUFF
A1020                                                SW/NDX   =     UPBUFF  +1
A1021                                                ENDBUF   =     UPBUFF  +16D
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P10211  SPACER

R1022   CONSTANTS USED IN THE ROLL CONTROL SYSTEM'
R1023   CONSTANTS ARE THE FOLLOWING' A = 9.1 DEG/SEC SQ, VM = 20 DEG/SEC,        T = 2 SEC,  TCDU = .1 SEC,
R1025   XMIN = 4 DEG, VMIN = 2 DEG/SEC, K = .25, A1 = 4.55 DEG/SEC SQ,          VI = 1 DEG/SEC, INTERCEPT WITH DZ SIDE
R1027   XBUF = 4 DEG

 1028                          15,3765  77464 1  -T-3      DEC   -203            CS
 1029                          15,3766  00012 1  VSQMIN    DEC   .61050061 E-3   VSQ MIN/4 A PI = 4/(4  (9.1)  180)
 1030   REF  3 LAST  265         4726           2T/TCDU   =     OCT50           T/TCDU  EXP-14   TCDU =.1SEC
 1031                          15,3767  23617 0  180/8ATT  DEC   .61813187      180/(8  (9.1) 4)=(180/ATT)  EXP -3
 1032   REF  2 LAST 1054      15,3772           -VMT/180  =     -VM/360K        = 20  (2) / 180
 1033   REF  3 LAST  576         4740           2JETT     =     4SECS           CS          2 (2) 100   INTEGER
 1034                          15,3770  01440 0  4JETT     DEC   800             CS          4 (2) 100   INTEGER
 1035                          15,3771  00266 0  XMIN/360  DEC   182           XMIN/360 = 4/ 360  EXP 14  = 182 INTEGER
 1036                          15,3772  70706 1  -VM/360K  DEC   -.22222222     =-20/( 360  (.25))
 1037   REF  4 LAST 1055       15,3767           1/16A1    =     180/8ATT
A10371                                                          1/16A1  = 180/(16 A1 TT)
A1038                                                           =180/(16  4.55  4)
 1039                          15,3773  00133 0  XS/360    DEC   91              =(XMIN +VI (T-1/K))/360 = 2/360 EXP 14
 1040   REF  2 LAST 1054       15,3773           BUFLIM    =     XS/360          4/(2  360)

 1041   REF  8 LAST 1060         4675           KTRCS     =     HALF            KT = (.25) 2 = .5
*** END OF DAPCSM .195 ***
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R0001   PROGRAM NAME- DOWN TELEMETRY PROGRAM
R0002   MOD NO.- 0      TO COMPLETELY REWRITE THE DOWN TELEMETRY PROGRAM AND DOWNLINK ERASABLE DUMP PROGRAM FOR THE
R0004                   PURPOSE OF SAVING APPROXIMATELY 150 WORDS OF CORE STORAGE.
R0006                   THIS CHANGE REQUIRES AN ENTIRELY NEW METHOD OF SPECIFYING DOWNLINK LISTS.REFER TO DOWNLINK
R0008                   LISTS LOG SECTION FOR MORE DETAILS. HOWEVER THIS CHANGE WILL NOT AFFECT THE GROUND PROCESSING
R0010                   OF DOWN TELEMETRY DATA.
R0011   MOD BY-  KILROY, SMITH, DEWITT
R0012   DATE-    02OCT67
R0013   AUTHORS- KILROY, SMITH, DEWITT, DEWOLF, FAGIN
R0014   LOG SECTION- DOWN-TELEMETRY PROGRAM
R0015   FUNCTIONAL DESCRIPTION- THIS ROUTINE IS INITIATED BY TELEMETRY END
R0016           PULSE FROM THE DOWNLINK TELEMETRY CONVERTER. THIS PULSE OCCURS
R0017           AT 50 TIMES PER SEC(EVERY 20 MS) THEREFORE DODOWNTM IS
R0018           EXECUTED AT THESE RATES. THIS ROUTINE SELECTS THE APPROPRIATE
R0019           AGC DATA TO BE TRANSMITTED DOWNLINK AND LOADS IT INTO OUTPUT
R0020           CHANNELS 34 AND 35. THE INFORMATION IS THEN GATED OUT FROM THE
R0021           LGC IN SERIAL FASHION.
R0022           THIS PROGRAM IS CODED FOR A 2 SECOND DOWNLIST. SINCE DOWNRUPTS
R0023           OCCUR EVERY 20MS AND 2 AGC COMPUTER WORDS CAN BE PLACED IN
R0024           CHANNELS 34 AND 35 DURING EACH DOWNRUPT THE PROGRAM IS CAPABLE
R0025           OF SENDING 200 AGC WORDS EVERY 2 SECONDS.
R0026   CALLING SEQUENCE- NONE
R0027           PROGRAM IS ENTERED VIA TCF DODOWNTM WHICH IS EXECUTED AS A
R0028           RESULT OF A DOWNRUPT. CONTROL IS RETURNED VIA TCF RESUME WHICH
R0029           IN EFFECT IS A RESUME.
R0030   SUBROUTINES CALLED- NONE
R0031   NORMAL EXIT MODE- TCF RESUME
R0032   ALARM OR ABORT EXIT MODE- NONE
R0033   RESTART PROTECTION'
R0034           ON A FRESH START AND RESTART THE «STARTSUB« SUBROUTINE WILL INITIALIZE THE DOWNLIST POINTER(ACTUALLY
R0036           DNTMGOTO) TO THE BEGINNING OF THE CURRENT DOWNLIST(I.E. CURRENT CONTENTS OF DNLSTADR). THIS HAS THE
R0038           EFFECT OF IGNORING THE REMAINDER OF THE DOWNLIST WHICH THE DOWN-TELEMETRY PROGRAM WAS WORKING ON WHEN
R0040           THE RESTART(OR FRESH START) OCCURRED AND RESUME DOWN TELEMETRY FROM THE BEGINNING OF THE CURRENT
R0042           DOWNLIST.
R0043           ALSO OF INTEREST IS THE FACT THAT ON A RESTART THE AGC WILL ZERO DOWNLINK CHANNELS 13, 34 AND 35.
R0047   DOWNLINK LIST SELECTION'
R0048           THE APPROPRIATE DOWNLINK LISTS ARE SELECTED BY THE FOLLOWING'
R0049           1. FRESH START
R0050           2. V37EXXE  WHERE XX = THE MAJOR MODE BEING SELECTED.
R0051           3. UPDATE PROGRAM(P27)
R0052           4.      NON-V37 SELECTABLE TYPE PROGRAMS(E.G. AGS INITIALIZATION(SUNDANCE,LUMINARY) AND P61-P62
R00522                  TRANSITION(COLOSSUS) ETC.).
R00525  DOWNLINK LIST RULES AND LIMITATIONS'
R00526          READ SECTION(S) WHICH FOLLOW «DEBRIS« WRITEUP.
R0053   OUTPUT-  EVERY 2 SECONDS 100 DOUBLE PRECISION WORDS(I.E. 200 LGC
R0054           COMPUTER WORDS) ARE TRANSMITTED VIA DOWNLINK.
R0055   ERASABLE INITIALIZATION REQUIRED- NONE
R0056           «DNTMGOTO« AND «DNLSTADR« ARE INITIALIZED BY THE FRESH START PROGRAM.
R0058   DEBRIS(ERASABLE LOCATIONS DESTROYED BY THIS PROGRAM)-
R0059           LDATALST,DNTMBUFF TO DNTMBUFF +21D,TMINDEX,DNQ.
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P0065  DODOWNTM IS ENTERED EVERY 20 MS BY AN INTERRUPT TRIGGERED BY THE
R0066  RECEIPT OF AN ENDPULSE FROM THE SPACECRAFT TELEMETRY PROGRAMMER.

R0067  NOTES REGARDING DOWNLINK LISTS ASSOCIATED WITH THIS PROGRAM'
R0068  1. DOWNLISTS. - DOWNLISTS MUST BE COMPILED IN THE SAME BANK AS THE
R0069     DOWN-TELEMETRY PROGRAM. THIS IS DONE FOR EASE OF CODING, FASTER
R0070     EXECUTION.
R0075  2. EACH DOWNLINK LIST CONSISTS OF A CONTROL LIST AND A NUMBER OF
R0076     SUBLISTS.
R0077  3. A SUBLIST REFERS TO A SNAPSHOT OR DATA COMMON TO THE SAME OR OTHER
R0078     DOWNLINK LISTS.  ANY SUBLIST CONTAINING COMMON DATA NEEDS TO BE
R0079     CODED ONLY ONCE FOR THE APPLICABLE DOWNLINK LISTS.
R0080  4. SNAPSHOT SUBLISTS REFER SPECIFICALLY TO HOMOGENOUS DATA WHICH MUST BE
R0081     SAVED IN A BUFFER DURING ONE DOWNRUPT.
R0082  5. THE 1DNADR FOR THE 1ST WORD OF SNAPSHOT DATA IS FOUND AT THE END
R0083     OF EACH SNAPSHOT SUBLIST, SINCE THE PROGRAM CODING SENDS THIS DP WORD
R0084     IMMEDIATELY AFTER STORING THE OTHERS IN THE SNAPSHOT BUFFER.
R0085  6. ALL LISTS ARE COMBINATIONS OF CODED ERASABLE ADDRESS CONSTANTS
R0086     CREATED FOR THE DOWNLIST PROGRAM.
R0087        A. 1DNADR              1-WORD DOWNLIST ADDRESS.
R0088           SAME AS ECADR, BUT USED WHEN THE WORD ADDRESSED IS THE LEFT
R0089           HALF OF A DOUBLE-PRECISION WORD FOR DOWN TELEMETRY.
R0090        B. 2DNADR - 6DNADR     N-WORD DOWNLIST ADDRESS, N = 2 - 6.
R0091           SAME AS 1DNADR, BUT WITH THE 4 UNUSED BITS OF THE ECADR FORMAT
R0092           FILLED IN WITH 0001-0101.  USED TO POINT TO A LIST OF N DOUBLE-
R0093           PRECISION WORDS, STORED CONSECUTIVELY, FOR DOWN TELEMETRY.
R0094        C. DNCHAN              DOWNLIST CHANNEL ADDRESS.
R0095           SAME AS 1DNADR, BUT WITH PREFIX BITS 0111.  USED TO POINT TO
R0096           A PAIR OF CHANNELS FOR DOWN TELEMETRY.
R0097        D. DNPTR               DOWN TELEMETRY SUBLIST POINTER.
R0098         SAME AS CAF BUT TAGGED AS A CONSTANT. USED IN CONTROL LIST TO POINT TO A SUBLIST.
R0100         CAUTION--- A DNPTR CANNOT BE USED IN A SUBLIST.
R0101  7. THE WORD ORDER CODE IS SET TO ZERO AT THE BEGINNING OF EACH DOWNLIST (I.E. CONTROL LIST) AND WHEN
R0103     A «1DNADR TIME2« IS DETECTED IN THE CONTROL LIST(ONLY).
R0104  8. IN THE SNAPSHOT SUBLIST ONLY, THE DNADR«S CANNOT POINT TO THE FIRST WORD OF ANY EBANK.

R0106  DOWNLINK LIST RESTRICTIONS'
R0107    (THE FOLLOWING POINTS MAY BE LISTED ELSEWHERE BUT ARE LISTED HERE SO  IT IS CLEAR THAT THESE THINGS CANNOT BE
R0109    DONE)

R0110  1. SNAPSHOT DOWNLIST'
R0111    (A) CANNOT CONTAIN THE FOLLOWING ECADRS(I.E. 1DNADR«S)' 0, 400, 1000, 1400, 2000, 2400, 3000, 3400.
R0113    (B) CAN CONTAIN ONLY 1DNADR«S

R0114  2. ALL DOWNLINKED DATA(EXCEPT CHANNELS) IS PICKED UP BY A ±DCA±SO DOWNLINK LISTS CANNOT CONTAIN THE
R0116     EQUIVALENT OF THE FOLLOWING ECADRS(I.E. IDNADRS)' 377, 777, 1377, 1777, 2377, 27777, 3377, 3777.

R0118     (NOTE' THE TERM EQUIVALENT « MEANT THAT THE IDNADR  TO 6DNADR  WILL BE PROCESSED LIKE 1 TO 6 ECADRS)

R0120  3. CONTROL LISTS AND SUBLISTS CANNOT HAVE ENTRIES = OCTAL 00000 OR OCTAL 77777
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R0122  4. THE «1DNADR TIME2« WHICH WILL CAUSE THE DOWNLINK PROGRAM TO SET THE WORDER CODE TO 3 MUST APPEAR IN THE
R0124     CONTROL SECTION OF THE DOWNLIST.

R0125  5. «DNCHAN 0« CANNOT BE USED.

R0126  6. «DNPTR 0« CANNOT BE USED.

R0127  7. DNPTR CANNOT APPEAR IN A SUBLIST.

R0128
R0129  EBANK SETTINGS
R0130          IN THE PROCESS OF SETTING THE EBANK(WHEN PICKING UP DOWNLINK DATA) THE DOWN TELEMETRY PROGRAM PUTS
R0132          «GARBAGE« INTO BITS15-12 OF EBANK. HUGH BLAIR-SMITH WARNS US THAT BITS15-12 OF EBANK MAY BECOME
R0134          SIGNIFICANT SOMEDAY IN THE FUTURE. IF/WHEN THAT HAPPENS, THE PROGRAM SHOULD INSURE(BY MASKING ETC.)
R0136          THAT BITS15-12 OF EBANK ARE ZERO.
R0137  INITIALIZATION REQUIRED- TO INTERRUPT CURRENT LIST AND START A NEW ONE..
R0138      1.  ADRES OF DOWNLINK LIST INTO DNLSTADR
R0139      2.  NEGONE INTO SUBLIST
R0140      3.  NEGONE INTO DNECADR

0142                          22,3505                        BANK    22
0143  REF   2  LAST  166      05,2000                        SETLOC  DOWNTELM
0144                          05,3342                        BANK

0145  REF  23  LAST  175        0340                         EBANK=  DNTMBUFF

0146  REF   1                                                COUNT   05/DPROG

0147  REF  21  LAST 1044      05,3342  54 016 1  DODOWNTM  TS      BANKRUPT
0148                          05,3343  0 0006 1            EXTEND
0149  REF  17  LAST 1044      05,3344  22 012 1            QXCH    QRUPT          SAVE Q
0150  REF  49  LAST 1028      05,3345  3 4704 0            CA      BIT7           SET WORD ORDER CODE TO 1. EXCEPTION- AT
0151                          05,3346  0 0006 1            EXTEND                 THE BEGINNING OF EACH LIST THE WORD
0152  REF  12  LAST 1033      05,3347  05 013 0            WOR     CHAN13         CODE WILL BE SET BACK TO 0.
0153  REF   3  LAST  254      05,3350  0 0335 1            TC      DNTMGOTO       GO TO APPROPRIATE PHASE OF PROGRAM

0154  REF  19  LAST  936      05,3351  3 7716 0  DNPHASE1  CA      NEGONE         INITIALIZE ALL CONTROL WORDS
0155  REF   1                 05,3352  54 337 1            TS      SUBLIST        WORDS TO MINUS ONE
0156  REF   1                 05,3353  54 336 0            TS      DNECADR
0157  REF   1                 05,3354  3 3474 0            CA      LDNPHAS2       SET DNTMGOTO =0 ALL SUBSEQUENT DOWNRUPTS
0158  REF   4  LAST 1066      05,3355  54 335 0            TS      DNTMGOTO       GO TO DNPHASE2
0159  REF   1                 05,3356  1 3372 0            TCF     NEWLIST
0160  REF   2  LAST 1066      05,3357  10 336 0  DNPHASE2  CCS     DNECADR        SENDING OF DATA IN PROGRESS
0161  REF   1                 05,3360  0 3507 0  DODNADR   TC      FETCH2WD       YES - THEN FETCH THE NEXT 2 SP WORDS
0162  REF  27  LAST  786      05,3361   77753 0  MINTIME2-1DNADR  TIME2          NEGATIVE OF TIME2 1DNADR
0163                          05,3362  1 3363 0            TCF     +1             (ECADR OF  3776 + 74001 = 77777)

0164  REF   2  LAST 1066      05,3363  10 337 1            CCS     SUBLIST        IS THE SUBLIST IN CONTROL
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REF   1                05,3364  1 3522 0          TCF    NEXTINSL     YES
                       05,3365   74001 0  DNADRDCR OCT    74001        DNADR COUNT AND ECADR DECREMENTER

REF   1                05,3366  3 0334 0  CHKLIST  CA     CTLIST
                       05,3367  0 0006 1          EXTEND
REF   2  LAST 1066     05,3370  6 3372 1          BZMF   NEWLIST      IT WILL BE NEGATIVE AT END OF LIST
REF   1                05,3371  1 3377 0          TCF    NEXTINCL
REF   5  LAST  746     05,3372  50 332 0  NEWLIST  INDEX  DNLSTCOD
REF   1                05,3373  3 2342 0          CA     DNTABLE      INITIALIZE CTLIST WITH
REF   2  LAST 1067     05,3374  54 334 1          TS     CTLIST         STARTING ADDRESS OF NEW LIST
REF   6  LAST 1067     05,3375  4 0332 1          CS     DNLSTCOD
REF   1                05,3376  1 3612 0          TCF    SENDID +3
REF   3  LAST 1067     05,3377  50 334 0  NEXTINCL INDEX  CTLIST
                       05,3400  3 0000 1          CA     0
REF 264  LAST 1059     05,3401  10 000 0          CCS    A
REF   4  LAST 1067     05,3402  24 334 0          INCR   CTLIST       SET POINTER TO PICK UP NEXT CTLIST WORD
                       05,3403  1 3407 0          TCF    +4           ON NEXT ENTRY TO PROG. (A SHOULD NOT =0)
REF   5  LAST 1067     05,3404  56 334 0          XCH    CTLIST       SET CTLIST TO NEGATIVE AND PLACE(CODING)
                       05,3405  4 0000 0          COM                 UNCOMPLEMENTED DNADR INTO A.    (FOR LA)
REF   6  LAST 1067     05,3406  56 334 0          XCH    CTLIST                                       (ST IN )
REF 265  LAST 1067     05,3407  24 000 1   +4     INCR   A                                            (CTLIST)
REF   3  LAST 1066     05,3410  54 336 0          TS     DNECADR      SAVE DNADR
REF   1                05,3411  6 3361 0          AD     MINTIME2     TEST FOR TIME2 (NEG. OF ECADR)
REF 266  LAST 1067     05,3412  10 000 0          CCS    A
REF   1                05,3413  1 3417 1          TCF    SETWO +1     DON∝T SET WORD ORDER CODE
                       05,3414   47777 0  MINB1314 OCT    47777        MINUS BIT 13 AND 14  (CAN∝T GET HERE)
REF   2  LAST 1067     05,3415  1 3417 1          TCF    SETWO +1     DON∝T SET WORD ORDER CODE
REF   1                05,3416  0 3441 0  SETWO   TC     WOZERO       GO SET WORD ORDER CODE TO ZERO.
REF   4  LAST 1067     05,3417  3 0336 1   +1     CA     DNECADR      RELOAD A WITH THE DNADR.
REF   1                05,3420  6 3414 0   +2     AD     MINB1314     IS THIS A REGULAR DNADR∝
                       05,3421  0 0006 1          EXTEND
REF   2  LAST 1066     05,3422  6 3507 0          BZMF   FETCH2WD     YES. (A MUST NEVER BE ZERO)
REF   1                05,3423  6 7710 0          AD     MINB12       NO- IS IT A POINTER (DNPTR) OR A
                       05,3424  0 0006 1          EXTEND                 CHANNEL(DNCHAN)
REF   1                05,3425  6 3445 1          BZMF   DODNPTR      IT∝S A POINTER. (A MUST NEVER BE ZERO)

                       05,3426  0 0006 1  DODNCHAN TC     6           (EXECUTED AS EXTEND) IT S A CHANNEL
REF   5  LAST 1067     05,3427  50 336 1          INDEX  DNECADR
                       05,3430  44∝000 1          INDEX  0 -4000      (EXECUTED AS READ)
REF 155  LAST 1059     05,3431  54 001 1          TS     L
                       05,3432  0 0006 1          TC     6            (EXECUTED AS EXTEND)
REF   6  LAST 1067     05,3433  50 336 1          INDEX  DNECADR
                       05,3434  43∝777 1          INDEX  0 -4001      (EXECUTED AS READ)
REF   7  LAST 1067     05,3435  54 336 0          TS     DNECADR      SET DNECADR
REF  20  LAST 1066     05,3436  3 7716 0          CA     NEGONE          TO MINUS
REF   8  LAST 1067     05,3437  56 336 1          XCH    DNECADR             WHILE PRESERVING A.
REF   1                05,3440  1 3535 0          TCF    DNTMEXIT     GO SEND CHANNELS

REF  50  LAST 1066     05,3441  4 4704 1  WOZERO  CS     BIT7
                       05,3442  0 0006 1          EXTEND
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 0213   REP  13  LAST 1066   05,3443  03 013 0          WAND   CHAN13        SET WORD ORDER CODE TO ZERO
 0214   REP 210  LAST 1055   05,3444  0 0002 0           TC     Q             RETURN TO CALLER

 0215   REP   9  LAST 1067   05,3445  50 336 1  DODNPTR  INDEX  DNECADR      DNECADR CONTAINS ADRES OF SUBLIST
 0216                        05,3446  0 0000 1           0      0             CLEAR AND ADD LIST ENTRY INTO A.
 0217   REP 267  LAST 1067   05,3447  10 000 0           CCS    A             IS THIS A SNAPSHOT SUBLIST
 0218   REP  10  LAST 1068   05,3450  3 0336 1           CA     DNECADR       NO, IT IS A REGULAR SUBLIST.
 0219   REP   1              05,3451  1 3521 0           TCF    DOSUBLST      A MUST NOT BE ZERO.

 0220   REP  11  LAST 1068   05,3452  56 336 1           XCH    DNECADR       YES, IT IS A SNAPSHOT SUBLIST.
 0221   REP   3  LAST 1066   05,3453  54 337 1           TS     SUBLIST       C(DNECADR) INTO SUBLIST
 0222   REP 207  LAST 1059   05,3454  3 4714 1           CAF    ZERO                A     INTO    A
 0223   REP   2  LAST   71   05,3455  56 336 1           XCH    TMINDEX       (NOTE.. TMINDEX = DNECADR)
R0224   THE FOLLOWING CODING (FROM SNAPLOOP TO SNAPEND) IS FOR THE PURPOSE OF TAKING A SNAPSHOT OF 12 DP REGISTERS.
R0226   THIS IS DONE BY SAVING 11 DP REGISTERS IN DNTMBUFF AND SENDING THE FIRST DP WORD IMMEDIATELY.
R0228   THE SNAPSHOT PROCESSING IS THE MOST TIME CONSUMING AND THEREFORE THE CODING AND LIST STRUCTURE WERE DESIGNED
R0230   TO MINIMIZE TIME. THE TIME OPTIMIZATION RESULTS IN RULES UNIQUE TO THE SNAPSHOT PORTION OF THE DOWNLIST.
R0232   THESE RULES ARE.....
R0233                1.   ONLY 1DNADR=S CAN APPEAR IN THE SNAPSHOT SUBLIST
R0234                2.   THE 1DNADR=S CANNOT REFER TO THE FIRST LOCATION IN ANY BANK.
 0236   REP  42  LAST 1039   05,3456  54 003 0  SNAPLOOP TS     EBANK         SET EBANK
 0237   REP   3  LAST  372   05,3457  7 4373 0           MASK   LOW8          ISOLATE RELATIVE ADDRESS
 0238                        05,3460  0 0006 1           EXTEND
 0239   REP 268  LAST 1068   05,3461  5 0000 1           INDEX  A
 0240                        E3,1401                     EBANK= 1401
 0241                        05,3462  3 1402 0           DCA    1401          PICK UP 2 SNAPSHOT WORDS.
 0242   REP  24  LAST 1066      0340                     EBANK= DNTMBUFF
 0243   REP   3  LAST 1068   05,3463  50 336 1           INDEX  TMINDEX
 0244   REP  25  LAST 1068   05,3464  52 341 0           DXCH   DNTMBUFF      STORE 2 SNAPSHOT WORDS IN BUFFER
 0245   REP   4  LAST 1068   05,3465  24 336 1           INCR   TMINDEX       SET BUFFER INDEX FOR NEXT 2 WORDS.
 0246   REP   5  LAST 1068   05,3466  24 336 1           INCR   TMINDEX
 0247   REP   4  LAST 1068   05,3467  24 337 0  SNAPAGN  INCR   SUBLIST       SET POINTER TO NEXT 2 WORDS OF SNAPSHOT
 0248   REP   5  LAST 1068   05,3470  50 337 0           INDEX  SUBLIST
 0249                        05,3471  0 0000 1           0      0             = CA SSSS (SSSS = NEXT ENTRY IN SUBLIST)
 0250   REP 269  LAST 1068   05,3472  10 000 0           CCS    A             TEST FOR LAST TWO WORDS OF SNAPSHOT.
 0251   REP   1              05,3473  1 3456 1           TCF    SNAPLOOP      NOT LAST TWO.
 0252   REP   1              05,3474  03357 0  LDNPHAS2 GENADR DNPHASE2
 0253   REP   6  LAST 1068   05,3475  54 337 1           TS     SUBLIST       YES, LAST.  SAVE A.
 0254   REP  21  LAST 1067   05,3476  3 7716 0           CA     NEGONE        SET DNECADR AND
 0255   REP  12  LAST 1068   05,3477  54 336 0           TS     DNECADR           SUBLIST POINTERS
 0256   REP   7  LAST 1068   05,3500  56 337 0           XCH    SUBLIST               TO NEGATIVE VALUES.
 0257   REP  43  LAST 1068   05,3501  54 003 0           TS     EBANK
 0258   REP   4  LAST 1068   05,3502  7 4373 0           MASK   LOW8
 0259                        05,3503  0 0006 1           EXTEND
 0260   REP 270  LAST 1068   05,3504  5 0000 1           INDEX  A
 0261                        E3,1401                     EBANK= 1401
```

L DOWN-TELEMETRY PROGRAM

```
0262                        05,3505  3 1402 0          DCA     1401          PICK UP FIRST 2 WORDS OF SNAPSHOT.
0263  REF  26  LAST 1068       0340                    EBANK=  DNTMBUFF
0264  REF   2  LAST 1067    05,3506  1 3535 0  SNAPEND  TCF     DNTMEXIT        NOW GO SEND THEM.

0265  REF  13  LAST 1068    05,3507  3 0336 1  FETCH2WD CA      DNECADR
0266  REF  44  LAST 1068    05,3510  54 003 0          TS      EBANK         SET EBANK
0267  REF   5  LAST 1068    05,3511  7 4373 0          MASK    LOW8          ISOLATE RELATIVE ADDRESS
0268  REF 156  LAST 1067    05,3512  54 001 1          TS      L
0269  REF   1               05,3513  3 3365 1          CA      DNADRDCR      DECREMENT COUNT AND ECADR
0270  REF  14  LAST 1069    05,3514  26 336 0          ADS     DNECADR
0271                        05,3515  0 0006 1          EXTEND
0272  REF 157  LAST 1069    05,3516  5 0001 0          INDEX   L
0273                        E3,1400                    EBANK=  1400
0274                        05,3517  3 1401 0          DCA     1400          PICK UP 2 DATA WORDS
0275  REF  27  LAST 1069       0340                    EBANK=  DNTMBUFF
0276  REF   3  LAST 1069    05,3520  1 3535 0          TCF     DNTMEXIT        NOW GO SEND THEM.

0277  REF   8  LAST 1068    05,3521  54 337 1  DOSUBLST TS      SUBLIST       SET SUBLIST POINTER
0278  REF   9  LAST 1069    05,3522  50 337 0  NEXTINSL INDEX   SUBLIST
0279                        05,3523  0 0000 1          0       0             = CA SSSS (SSSS = NEXT ENTRY IN SUBLIST)
0280  REF 271  LAST 1068    05,3524  10 000 0          CCS     A             IS IT THE END OF THE SUBLIST
0281  REF  10  LAST 1069    05,3525  24 337 0          INCR    SUBLIST       NO-
0282                        05,3526  1 3532 1          TCF     +4
0283  REF  11  LAST 1069    05,3527  54 337 1          TS      SUBLIST       SAVE A.
0284  REF  22  LAST 1068    05,3530  3 7716 0          CA      NEGONE        SET SUBLIST TO MINUS
0285  REF  12  LAST 1069    05,3531  56 337 0          XCH     SUBLIST       RETRIEVE A.
0286  REF 272  LAST 1069    05,3532  24 000 1  +4      INCR    A
0287  REF  15  LAST 1069    05,3533  54 336 0          TS      DNECADR       SAVE DNADR
0288  REF   3  LAST 1067    05,3534  1 3420 0          TCF     SETWO +2      GO USE COMMON CODING(PROBLEMS WOULD
A0289                                                                        OCCUR IF THE PROGRAM ENCOUNTERED A
A0290                                                                        DNPTR NOW)

0291                        05,3535  0 0006 1  DNTMEXIT EXTEND                DOWN-TELEMETRY EXIT
0292  REF   1               05,3536  01 034 1          WRITE   DNTM1         TO SEND A + L TO CHANNELS 34 + 35
0293  REF 158  LAST 1069    05,3537  3 0001 0          CA      L             RESPECTIVELY
0294                        05,3540  0 0006 1  TMEXITL  EXTEND
0295  REF   1               05,3541  01 035 0          WRITE   DNTM2
0296  REF  47  LAST 1061    05,3542  1 5222 1  TMRESUME TCF     RESUME        EXIT TELEMETRY PROGRAM VIA RESUME.

0297  REF   1                  7710            MINB12   EQUALS  -1/8
0298  REF   6  LAST 1068       0336            DNECADR  EQUALS  TMINDEX
0299  REF   1                  0334            CTLIST   EQUALS  LDATALST
0300  REF   1                  0337            SUBLIST  EQUALS  DNO
```

```
L       DOWN-TELEMETRY PROGRAM                                                    USER«S PAGE NO.  8      E0 S3

P0301   SUBROUTINE NAME- DNDUMP
R0302   FUNCTIONAL DESCRIPTION - TO SEND(DUMP) ALL ERASABLE STORAGE «N« TIMES.(N = 1 TO 4). BANKS ARE SENT ONE AT A TIME
R0304           EACH BANK IS PRECEEDED BY AN ID WORD, SYNCH BITS, ECADR AND TIME1 FOLLOWED BY THE 256D WORDS OF EACH
R0306           EBANK. EBANKS ARE DUMPED IN ORDER(I.E. EBANK 0 FIRST, THEN EBANK1 ETC.)
R0308   CALLING SEQUENCE- THE GROUND OR ASTRONAUT BY KEYING V74E CAN INITIALIZE THE DUMP.
R0310           AFTER KEYING IN V74E THE CURRENT DOWNLIST WILL BE IMMEDIATELY TERMINATED AND THE DOWNLINK ERASABLE DUMP
R0312           WILL BEGIN.
R0313           ONCE INITIATED THE DOWNLINK ERASABLE DUMP CAN BE TERMINATED (AND INTERRUPTED DOWNLIST REINSTATED) ONLY
R0315           BY THE FOLLOWING'
R0316            1. A FRESH START
R0317            2. COMPLETION OF ALL DOWNLINK DUMPS REQUESTED (ACCORDING TO BITS SET IN DUMPCNT). NOTE THAT DUMPCNT
R0319               CAN BE ALTERED BY A V21N01.
R0320            3. AND INVOLUNTARILY BY A RESTART.
R0321   NORMAL EXIT MODE- TCF DNPHASE1
R0322   ALARM OR ABORT MODE- NONE
R0323   *SUBROUTINES CALLED- NONE.
R0324   ERASABLE INITIALIZATION REQUIRED-
R0325           DUMPCNT   OCT  20000   IF 4 COMPLETE ERASABLE DUMPS ARE DESIRED
R0326           DUMPCNT   OCT  10000   IF 2 COMPLETE ERASABLE DUMPS ARE DESIRED
R0327           DUMPCNT   OCT  04000   IF 1 COMPLETE ERASABLE DUMP  IS  DESIRED
R0328   DEBRIS- DUMPLOC, DUMPSW, DNTMGOTO, EBANK AND CENTRAL REGISTERS
R0329   TIMING-   TIME(IN SECS) = ((NO.DUMPS)*(NO.EBANKS)* (WDSPEREBANK + NO.IDWDS)) / NO.WDSPERSEC
R0331             TIME(IN SECS) = (   4    )*(    8    )* (    256     +     4    )  /     100
R0333        THUS TIME(IN SECS TO SEND DUMP OF ERASABLE 4 TIMES VIA DOWNLINK) = 83.2 SECONDS

R0335   STRUCTURE OF ONE EBANK AS IT IS SENT BY DOWNLINK PROGRAM-
R0336      (REMINDER-THIS ONLY DESCRIBES ONE OF THE 8 EBANKS X 4 (DUMPS) = 32 EBANKS WHICH WILL BE SENT BY DNDUMP)
R0338          DOWNLIST                                          W
R0339           WORD   TAKEN FROM CONTENTS OF   EXAMPLE  0  COMMENTS

R0340             1    ERASID                    0177X   0  DOWNLIST I.D. FOR DOWNLINK ERASABLE DUMP (X=7 CSM, 6 LM)
R0342             2    LOWIDCOD                  77340   1  DOWNLINK SYNCH BITS.(SAME ONE USED IN ALL OTHER DOWNLISTS)
R0344             3    DUMPLOC                   13400   1  (SEE NOTES ON DUMPLOC)1= 3RD ERAS DUMP, 3400=ECADR OF 5TH WD
R0346             4    TIME1                     14120   1  TIME IN CENTISECONDS
R0347             5    FIRST WORD OF EBANK X     03400   1  IN THIS EXAMPLE THIS WORD = CONTENTS OF E7,1400 (ECADR 3400)
R0349             6    2ND   WORD OF EBANK X     00142   1  IN THIS EXAMPLE THIS WORD = CONTENTS OF E7,1401 (ECADR 3401)
R0351             7    3RD   WORD OF EBANK X     00142   1  IN THIS EXAMPLE THIS WORD = CONTENTS OF E7,1402 (ECADR 3402)
R0353             .                                      1
R0354             .                                      1
R0355             .                                      1
R0356           260D   256TH WORD OF EBANK X     03777   1  IN THIS EXAMPLE THIS WORD = CONTENTS OF E7,1777 (ECADR 3777)

R0358   NOTE- DUMPLOC CONTAINS THE COUNTER AND ECADR FOR EACH WORD BEING SENT.
R0359        THE BIT STRUCTURE OF DUMPLOC IS FOLLOWS---
R0360                                        X = NOT USED
R0361          X ABC EEE RRRRRRRR          ABC = ERASABLE DUMP COUNTER(I.E. ABC = 0,1,2 OR 3 WHICH MEANS THAT
R0363                                            COMPLETE ERASABLE DUMP NUMBER  1,2,3 OR 4 RESPECTIVELY IS IN PROGRESS)
R0365                                      EEE = EBANK BITS
R0366                                 RRRRRRRR = RELATIVE ADDRESS WITHIN AN EBANK.
```

L DOWN-TELEMETRY PROGRAM

```
0368  REF 208  LAST 1068   05,3543  3 4714 1  DNDUMPI  CA    ZERO      INITIALIZE DOWNLINK
0369  REF   1               05,3544  54 336 0           TS    DUMPLOC   ERASABLE DUMP
0370  REF   2  LAST 1067   05,3545  0 3807 0   +2      TC    SENDID    GO SEND ID AND SYNCH BITS
0371  REF   1               05,3546  3 3555 1           CA    LDNDUMP1  SET DNTMGOTO
0372  REF   5  LAST 1066   05,3547  54 335 0           TS    DNTMGOTO  TO LOCATION FOR NEXT PASS
0373  REF  18  LAST 1061   05,3550  3 0025 0           CA    TIME1     PLACE TIME1
0374  REF 159  LAST 1069   05,3551  56 001 0           XCH   L         INTO L
0375  REF   2  LAST 1071   05,3552  3 0336 1           CA    DUMPLOC   AND ECADR OF THIS EBANK INTO A
0376  REF   4  LAST 1069   05,3553  1 3535 0           TCF   DNTMEXIT  SEND DUMPLOC AND TIME1

0377  REF   1               05,3554   03556 1  LDNDUMP  ADRES DNDUMP
0378  REF   1               05,3555   03571 1  LDNDUMP1 ADRES DNDUMP1

0379  REF  51  LAST 1057   05,3556  3 4711 1  DNDUMP   CA    TWO       INCREMENT ECADR IN DUMPLOC
0380  REF   3  LAST 1071   05,3557  26 336 0           ADS   DUMPLOC   TO NEXT DP WORD TO BE
0381  REF   6  LAST 1069   05,3560  7 4373 0           MASK  LOW8      DUMPED AND SAVE IT.
0382  REF 273  LAST 1069   05,3561  10 000 0           CCS   A         IS THIS THE BEGINNING OF A NEW EBANK
0383  REF   1               05,3562  1 3573 1           TCF   DNDUMP2   NO- THEN CONTINUE DUMPING
0384  REF   4  LAST 1071   05,3563  3 0336 1           CA    DUMPLOC   YES- IS THIS THE END OF THE
0385  REF   1               05,3564  7 0333 0           MASK  DUMPCNT   N TH(N = 1 TO 4) COMPLETE ERASABLE
0386  REF   7  LAST  986   05,3565  7 7671 1           MASK  PRIO34    DUMP(BIT14 FOR 4, BIT13 FOR 2 OR BIT12
0387  REF 274  LAST 1071   05,3566  10 000 0           CCS   A         FOR 1 COMPLETE ERASABLE DUMP(S)).
0388  REF   2  LAST  188   05,3567  1 3351 1           TCF   DNPHASE1  YES- START SENDING INTERRUPTED DOWNLIST
                                                                      AGAIN
A0389
0390  REF   2  LAST  254   05,3570  1 3545 1           TCF   DNDUMPI +2  NO- GO BACK AND INITIALIZE NEXT BANK

0391  REF   1               05,3571  3 3554 0  DNDUMP1  CA    LDNDUMP   SET DNTMGOTO
0392  REF   6  LAST 1071   05,3572  54 335 0           TS    DNTMGOTO  FOR WORDS 3 TO 256D OF CURRENT EBANK

0393  REF   5  LAST 1071   05,3573  3 0336 1  DNDUMP2  CA    DUMPLOC
0394  REF  45  LAST 1069   05,3574  54 003 0           TS    EBANK     SET EBANK
0395  REF   7  LAST 1071   05,3575  7 4373 0           MASK  LOW8      ISOLATE RELATIVE ADDRESS.
0396  REF 211  LAST 1068   05,3576  54 002 1           TS    Q         (NOTE' MASK INSTRUCTION IS USED TO PICK
0397  REF  14  LAST  695   05,3577  3 4713 0           CA    NEG0      UP ERASABLE REGISTERS SO THAT EDITING
0398  REF 160  LAST 1071   05,3600  54 001 1           TS    L         REGISTERS 20-23 WILL NOT BE ALTERED.)
0399  REF 212  LAST 1071   05,3601  50 002 0           INDEX Q
0400                       E3,1400                    EBANK= 1400     PICK UP LOW ORDER REGISTER OF PAIR
0401                       05,3602  7 1401 1          MASK  1401      OF ERASABLE REGISTERS.
0402  REF 161  LAST 1071   05,3603  56 001 0           XCH   L
0403  REF 213  LAST 1071   05,3604  50 002 0           INDEX Q         PICK UP HIGH ORDER REGISTER OF PAIR
0404                       05,3605  7 1400 0           MASK  1400      OF ERASABLE REGISTERS.
0405  REF  28  LAST 1069     0340                     EBANK= DNTMBUFF
0406  REF   5  LAST 1071   05,3606  1 3535 0           TCF   DNTMEXIT  GO SEND THEM
0407                       05,3607  0 0006 1  SENDID   EXTEND          **ENTRANCE USED BY ERASABLE DUMP PROG.**
0408  REF   7  LAST 1071   05,3610  22 335 1           QXCH  DNTMGOTO  SET DNTMGOTO SO NEXT TIME PROG WILL GO
0409  REF   1               05,3611  3 4747 1           CAF   ERASID    TO LOCATION FOLLOWING 'TC SENDID'

0410  REF 162  LAST 1071   05,3612  54 001 1           TS    L         **ENTRANCE USED BY REGULAR DOWNLINK PG**
```

L DOWN-TELEMETRY PROGRAM

USER=S PAGE NO. 10 E0 S3

```
0411  REP   2  LAST 1067   05,3613  0 3441 0      TC     WOZERO      GO SET WORD ORDER CODE TO ZERO
0412  REP   1               05,3614  3 2000 0      CAF    LOWIDCOD    PLACE SPECIAL ID CODE INTO L
0413  REP 163  LAST 1071   05,3615  56 001 0      XCH    L           AND ID BACK INTO A
0414  REP   6  LAST 1071   05,3616  1 3535 0      TCF    DNTMEXIT    SEND DOWNLIST ID CODE(S).
```

```
L       INTER-BANK COMMUNICATION                                                USER=S PAGE NO.   1      E0 S3

R0001           THE FOLLOWING ROUTINE CAN BE USED TO CALL A SUBROUTINE IN ANOTHER BANK. IN THE BANKCALL VERSION, THE
R0003   CADR OF THE SUBROUTINE IMMEDIATELY FOLLOWS THE  TC BANKCALL  INSTRUCTION, WITH C(A) AND C(L) PRESERVED.

 0005                           4555                        BLOCK  02
 00055  REF   1                                             COUNT  02/BANK

 0006   REF   4  LAST  413      4555  52 134 0  BANKCALL DXCH   BUF2          SAVE INCOMING A,L.
 0007   REF 214  LAST 1071      4556  50 002 0            INDEX  Q             PICK UP CADR.
 0008                           4557  3 0000 1            CA     0
 0009   REF 215  LAST 1073      4560  24 002 0            INCR   Q             SO WE RETURN TO THE LOC. AFTER THE CADR.

R0010           SWCALL IS IDENTICAL TO BANKCALL, EXCEPT THAT THE CADR ARRIVES IN A.

 0012   REF 164  LAST 1072      4561  54 001 1  SWCALL   TS     L
 0013   REF   3  LAST  376      4562  22 004 0            LXCH   FBANK         SWITCH BANKS, SAVING RETURN.
 0014   REF   7  LAST  613      4563  7 4747 0            MASK   LOW10         GET SUB-ADDRESS OF CADR.
 0015   REF 216  LAST 1073      4564  56 002 0            XCH    Q             A,L NOW CONTAINS DP RETURN.
 0016   REF   5  LAST 1073      4565  52 134 0            DXCH   BUF2          RESTORING INPUTS IF THIS IS A BANKCALL.
 0017   REF 217  LAST 1073      4566  50 002 0            INDEX  Q
 0018                           4567  0 2000 0            TC     10000         SETTING Q TO SWRETURN.

 0019   REF   6  LAST 1073      4570  56 134 1  SWRETURN XCH    BUF2 +1       COMES HERE TO RETURN TO CALLER. C(A,L)
 0020   REF   4  LAST 1073      4571  56 004 0            XCH    FBANK         ARE PRESERVED FOR RETURN.
 0021   REF   7  LAST 1073      4572  56 134 1            XCH    BUF2 +1
 0022   REF   8  LAST 1073      4573  0 0133 0            TC     BUF2
R0023           THE FOLLOWING ROUTINE CAN BE USED AS A UNILATERAL JUMP WITH C(A,L) PRESERVED AND THE CADR IMMEDIATELY
R0025   FOLLOWING THE TC POSTJUMP INSTRUCTION.

 0026   REF 218  LAST 1073      4574  56 002 0  POSTJUMP XCH    Q             SAVE INCOMING C(A).
 0027   REF 275  LAST 1071      4575  50 000 1            INDEX  A             GET CADR.
 0028                           4576  3 0000 1            CA     0

R0029           BANKJUMP IS THE SAME AS POSTJUMP, EXCEPT THAT THE CADR ARRIVES IN A.

 0031   REF   5  LAST 1073      4577  54 004 1  BANKJUMP TS     FBANK
 0032   REF   8  LAST 1073      4600  7 4747 0            MASK   LOW10
 0033   REF 219  LAST 1073      4601  56 002 0            XCH    Q             RESTORING INPUT C(A) IF THIS WAS A
 0034   REF 220  LAST 1073      4602  50 002 0  Q+10000   INDEX  Q             POSTJUMP.
 0035                           4603  1 2000 1  PRIO12    TCF    10000         PRIO12 = TCF   10000 = 12000
```

P0036 THE FOLLOWING ROUTINE GETS THE RETURN CADR SAVED BY SWCALL OR BANKCALL AND LEAVES IT IN A.

```
0038   REF    9   LAST 1073     4604  3 4747 1  MAKECADR CAF    LOW10
0039   REF    9   LAST 1073     4605  7 0133 1           MASK   BUF2
0040   REF   10   LAST 1074     4606  6 0134 1           AD     BUF2 +1
0041   REF  221   LAST 1073     4607  0 0002 0           TC     Q
00465  REF    4   LAST  374     4610  54 135 1  SUPDACAL TS     MPTEMP
0047   REF    6   LAST 1073     4611  56 004 0           XCH    FBANK          SET FBANK FOR DATA.
00475                           4612  0 0006 1           EXTEND
0048   REF   10   LAST  577     4613  04 007 1           ROR    SUPERBNK       SAVE FBANK IN BITS 15-11, AND
00485  REF    5   LAST 1074     4614  56 135 0           XCH    MPTEMP          SUPERBANK IN BITS 7-5.
0049   REF   10   LAST 1074     4615  7 4747 0           MASK   LOW10
00495  REF  165   LAST 1073     4616  56 001 0           XCH    L              SAVE REL. ADR. IN BANK, FETCH SUPERBITS.
0050                            4617  0 0004 0           INHINT                BECAUSE RUPT DOES NOT SAVE SUPERBANK.
00505                           4620  0 0006 1           EXTEND
0051   REF   11   LAST 1074     4621  01 007 1           WRITE  SUPERBNK       SET SUPERBANK FOR DATA.
0052   REF  166   LAST 1074     4622  50 001 0           INDEX  L
00525                           4623  3 2000 0           CA     10000          PINBALL (FIX MEM DISP) PREVENTS DCA HERE
0053   REF    6   LAST 1074     4624  56 135 0           XCH    MPTEMP         SAVE 1ST WD, FETCH OLD FBANK AND SBANK.
00534                           4625  0 0006 1           EXTEND
00535  REF   12   LAST 1074     4626  01 007 1           WRITE  SUPERBNK       RESTORE SUPERBANK.
0054                            4627  0 0003 1           RELINT
00545  REF    7   LAST 1074     4630  54 004 1           TS     FBANK          RESTORE FBANK.
0055   REF    7   LAST 1074     4631  3 0135 0           CA     MPTEMP         RECOVER FIRST WORD OF DATA.
00555                           4632  0 0002 0           RETURN                24 WDS. DATACALL 516 MU, SUPDACAL 432 MU
```

L INTER-BANK COMMUNICATION USER=S PAGE NO. 3 E0 S3

P0056 THE FOLLOWING ROUTINES ARE IDENTICAL TO BANKCALL AND SWCALL EXCEPT THAT THEY ARE USED IN INTERRUPT.

```
0058  REF   2  LAST  415    4633  52 073 1  IBNKCALL DXCH  RUPTREG3      USES RUPTREG3,4 FOR DP RETURN ADDRESS.
0059  REF 222  LAST 1074    4634  50 002 0           INDEX  Q
0060                       4635  3 0000 1           CAF    0
0061  REF 223  LAST 1075    4636  24 002 0           INCR   Q

0062  REF 167  LAST 1074    4637  54 001 1  ISWCALL  TS     L
0063  REF   8  LAST 1074    4640  22 004 0           LXCH   FBANK
0064  REF  11  LAST 1074    4641  7 4747 0           MASK   LOW10
0065  REF 224  LAST 1075    4642  56 002 0           XCH    Q
0066  REF   3  LAST 1075    4643  52 073 1           DXCH   RUPTREG3
0067  REF 225  LAST 1075    4644  50 002 0           INDEX  Q
0068                       4645  0 2000 0           TC     10000

0069  REF   3  LAST   66    4646  56 073 0  ISWRETRN XCH   RUPTREG4
0070  REF   9  LAST 1075    4647  56 004 0           XCH    FBANK
0071  REF   4  LAST 1075    4650  56 073 0           XCH    RUPTREG4
0072  REF   4  LAST 1075    4651  0 0072 1           TC     RUPTREG3
```

R0090 2. USPRCADR ACCESSES INTERPRETIVE CODING IN OTHER THAN THE USER=S FBANK. THE CALLING SEQUENCE IS AS FOLLOWS'

```
A0092                                      L      TC     USPRCADR
A0093                                      L+1    CADR   INTPRETX      INTPRETX IS THE INTERPRETIVE CODING
A0094                                                                  RETURN IS TO L+2

0103  REF   5  LAST  415    4652  54 164 0  USPRCADR TS    LOC          SAVE A
0104  REF  25  LAST  918    4653  3 4703 1           CA     BIT8
0105  REF   7  LAST  365    4654  54 023 1           TS     EDOP         EXIT INSTRUCTION TO EDOP
0106  REF  14  LAST  575    4655  3 0006 1           CA     BBANK
0107  REF   1                4656  54 165 1           TS     BANKSET      USER=S BBANK TO BANKSET
0108  REF 226  LAST 1075    4657  50 002 0           INDEX  Q
0109                       4660  3 0000 1           CA     0
0110  REF  10  LAST 1075    4661  54 004 1           TS     FBANK        INTERPRETIVE BANK TO FBANK
0111  REF  12  LAST 1075    4662  7 4747 0           MASK   LOW10        YIELDS INTERPRETIVE RELATIVE ADDRESS
0112  REF 227  LAST 1075    4663  56 002 0           XCH    Q            INTERPRETIVE ADDRESS TO Q, FETCHING L+1
0113  REF   6  LAST 1075    4664  56 164 1           XCH    LOC          L+1 TO LOC, RETRIEVING ORIGINAL A
0114  REF   1                4665  1 4602 0           TCF    Q+10000
```

P0117 THERE ARE FOUR POSSIBLE SETTINGS FOR CHANNEL 07. (CHANNEL 07 CONTAINS THE SUPERBANK SETTING.)
R0119
R0120 SUPERBANK SETTING S-REG. VALUE PSEUDO-FIXED BANK NUMBERS OCTAL PSEUDO ADDRESSES
R0121 ---------- ------- ------------ ------------ ------------

R0122 SUPERBANK 3 0XX 2000 - 3777 30 - 37 70000 - 107777 (WHERE XX CAN BE ANYTHING AND
R0124 WILL USUALLY BE SEEN AS 11)
R0126 SUPERBANK 4 100 2000 - 3777 40 - 47 110000 - 127777 (AS FAR AS IT CAN BE SEEN,
R0128 ONLY BANKS 40-43 WILL EVER BE
R0130 AND ARE PRESENTLY AVAILABLE)
R0132 SUPERBANK 5 101 2000 - 3777 50 - 57 130000 - 147777 (PRESENTLY NOT AVAILABLE TO
R0134 THE USER)
R0136 SUPERBANK 6 110 2000 - 3777 60 - 67 150000 - 167777 (PRESENTLY NOT AVAILABLE TO
R0138 THE USER)

R0142 *** THIS ROUTINE MAYBE CALLED BY ANY PROGRAM LOCATED IN BANKS 00 - 27. I.E., NO PROGRAM LIVING IN ANY
R0144 SUPERBANK SHOULD USE SUPERSW. ***

R0145 SUPERSW MAYBE CALLED IN THIS FASHION'

```
R0146          CAF    ABBCON        WHERE -- ABBCON  BBCON  SOMETHIN --
R0147          TCR    SUPERSW       (THE SUPERBNK BITS ARE IN THE BBCON)
R0148          ...    ...
R0149           .      .
R0150           .      .
```

R0151 OR IN THIS FASHION '

```
R0152          CAF    SUPERSET      WHERE SUPERSET IS ONE OF THE FOUR AVAILABLE
R0154          TCR    SUPERSW       SUPERBANK BIT CONSTANTS'
R0155          ...    ...
R0157                                          SUPER011 OCTAL 60
R0159           .      .                       SUPER100 OCTAL 100
R0161           .      .                       SUPER101 OCTAL 120
                                               SUPER110 OCTAL 140
```

```
 0163                          4666  0 0006 1  SUPERSW  EXTEND
 0164  REF  13  LAST 1074      4667  01 007 1           WRITE   SUPERBNK   WRITE BITS 7-6-5 OF THE ACCUMULATOR INTO
A0165                                                                     CHANNEL 07
 0166  REF 228  LAST 1075      4670  0 0002 0           TC      Q          TC TO INSTRUCTION FOLLOWING
A0167                                                                      TC  SUPERSW
```